

**AREA 8, PHASE III  
NATURAL RESOURCE  
RESTORATION DESIGN PLAN**

**FERNALD CLOSURE PROJECT  
FERNALD, OHIO**



**JANUARY 2004**

**U.S. DEPARTMENT OF ENERGY**

**21110-PL-0001  
REVISION 0  
FINAL**

**000001**

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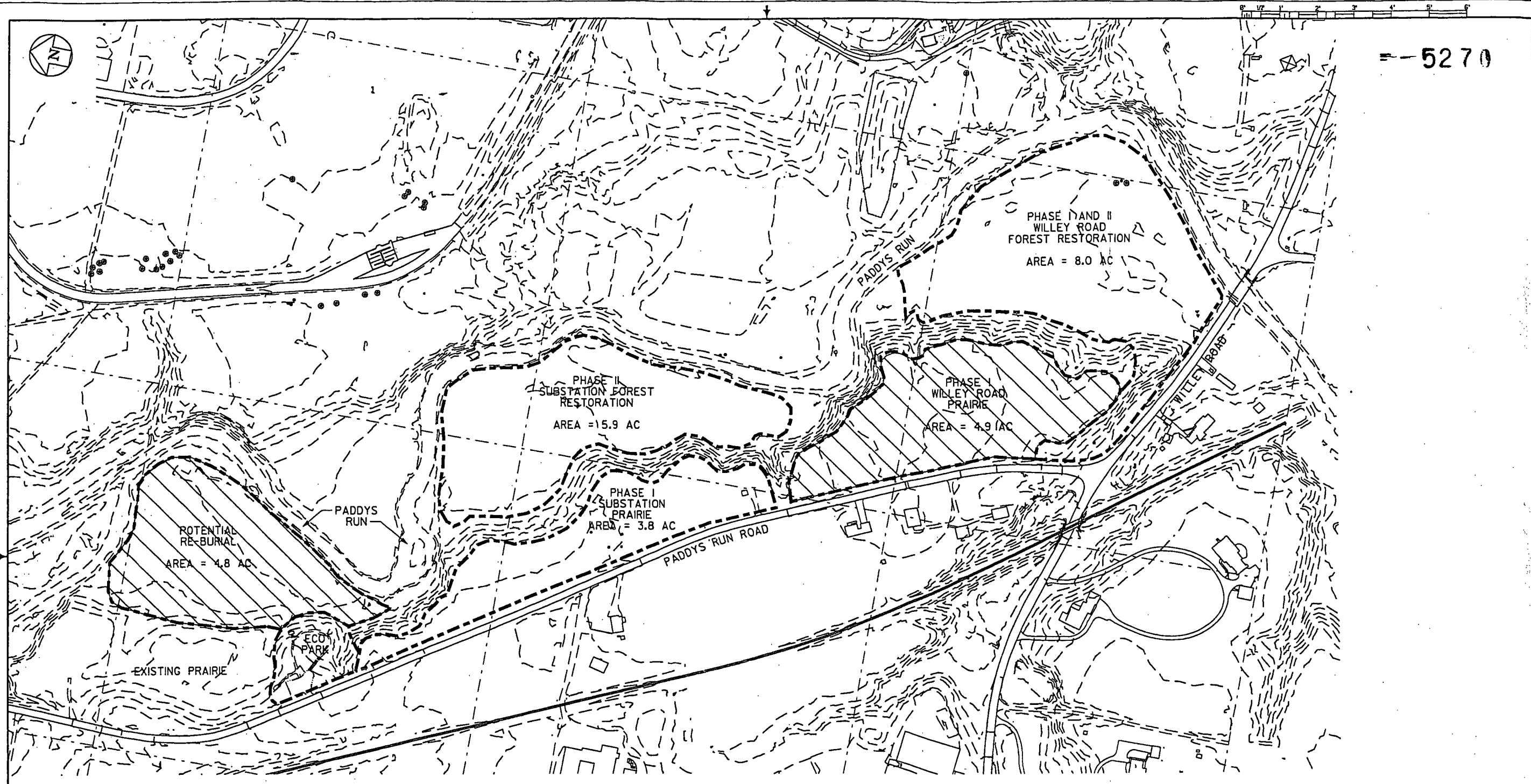
# LIST OF ACRONYMS AND ABBREVIATIONS

A8PIII	Area 8, Phase III
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
FCP	Fernald Closure Project
NRRDP	Natural Resource Restoration Design Plan
NRRP	Natural Resource Restoration Plan

## 1.0 PROJECT OVERVIEW

Area 8, Phase III (A8P3) is the fifth in a series of ecological restoration projects at the Fernald Closure Project (FCP). It encompasses approximately 43 acres along the western edge of the FCP property, within the Paddys Run West restoration scope of work. The conceptual restoration plan for the FCP is described in the Natural Resource Restoration Plan (NRRP, DOE 2002). Compensatory restoration of the FCP is part of the proposed settlement for natural resource damages under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA).

Restoration primarily consists of prairie establishment and forest restoration to expand the riparian corridor along Paddys Run. A8P3 is divided into two areas; A8P3 North and A8P3 South. The scope of restoration is broken in to six separate areas; three forest and three prairie. Two forest areas are located in A8P3 South. These include the Willey Road Forest Area and the Substation Forest Area. The third forest area is located within A8P3 North. Similarly, two prairie areas are located in A8P3 South and one in A8P3 North. Figure 1-1 shows the conceptual restoration plan for all of A8P3 South, and Figure 1-2 shows the conceptual restoration plan for A8P3 North.

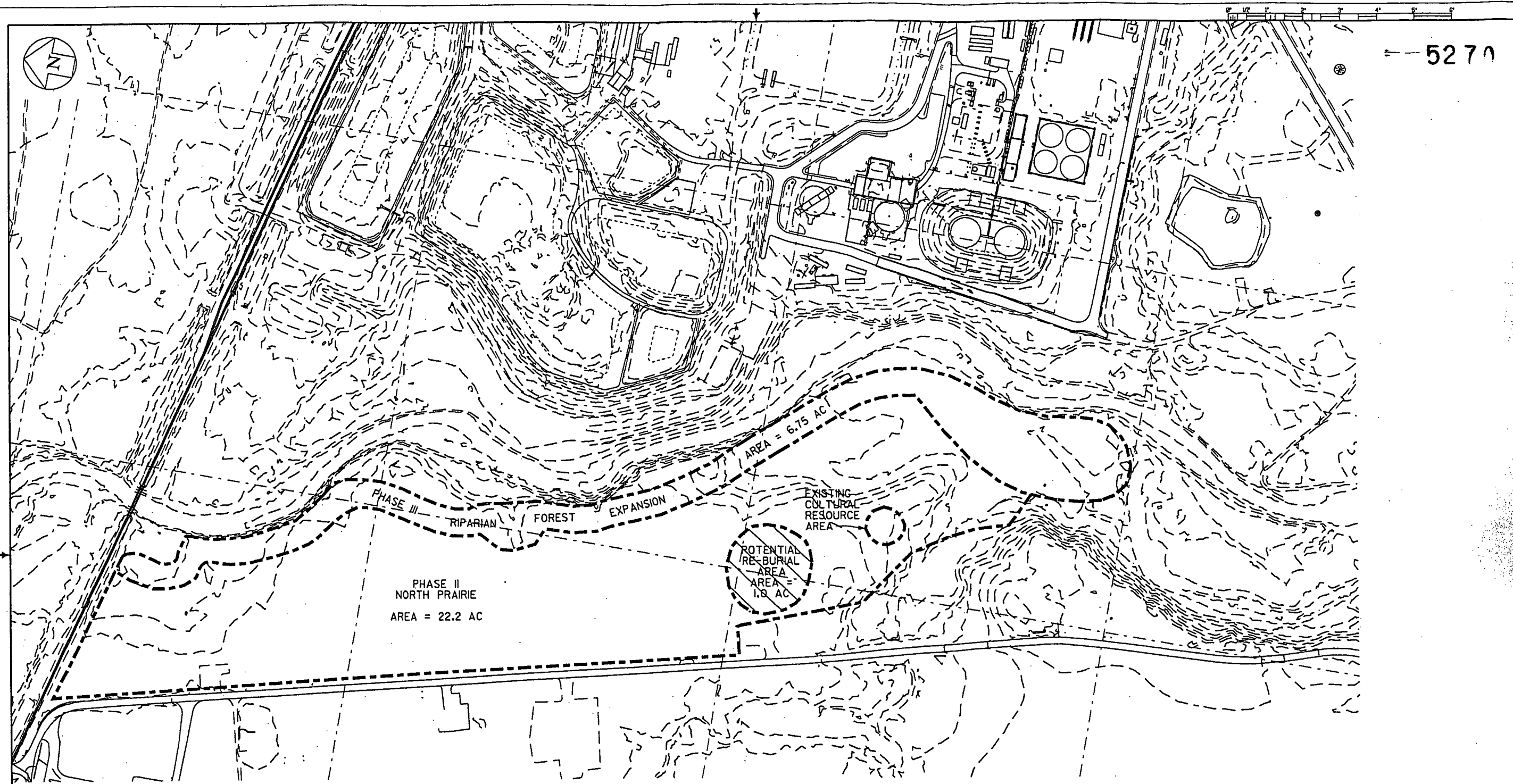


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POTENTIAL RE-BURIAL SITE

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CIVIL & STR.	SAFETY ENG.																														
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ENGINEER	PER. PROJECT
INSTRUMENT	WASTE MGMT.
MECHANICAL	SECURITY
CHECKED	PROJECTS
APPROVED	

Fernald Environmental  
Management Project  
**FLUOR FERNALD, INC.**  
U.S. DEPARTMENT OF ENERGY

PADDY'S RUN WEST RESTORATION  
AREA 8 PHASE III NORTH  
CONCEPTUAL RESTORATION PLAN  
DATE 06/29/02  
DRAWN K.L. RABBITT  
FIGURE I-2

FILE NAME: Area 8 Ph3 landscape plan sheet 1.dgn

**2.0 SEQUENCE OF ACTIVITIES**

Restoration of A8P3 will be conducted in three phases, starting in Fall 2003. Table 2-1 below demonstrates the sequence and timing of the individual areas.

**TABLE 2-1**  
**SEQUENCE OF A8P3 RESTORATION ACTIVITIES**

<b>Phase</b>	<b>Timeframe</b>	<b>Restoration Activities</b>
Site Prep	Summer 2003	<ul style="list-style-type: none"> <li>• Improve access points and gates</li> <li>• Improve and/or install gravel pads and access paths in A8P3 South</li> <li>• Initiate vegetation removal in the Willey Road Forest Area and the two prairie areas within A8P3 South</li> </ul>
I	Fall 2003	<ul style="list-style-type: none"> <li>• Install trees and shrubs within approximately 3.5 acres of the Willey Road Forest Area</li> </ul>
II	Spring/ Summer 2004	<ul style="list-style-type: none"> <li>• Complete vegetation removal in A8P3 South</li> <li>• Complete vegetation removal in A8P3 North</li> <li>• Improve and/or install gravel pads, access paths, and staging areas in A8P3 North</li> <li>• Locate and plug existing drain tiles within the A8P3 North prairie area</li> </ul>
III	Fall 2004	<ul style="list-style-type: none"> <li>• Install trees and shrubs within the remainder of the Willey Road Forest Area</li> <li>• Install trees and shrubs within the Substation Forest Area</li> <li>• Seed the two A8P3 South Prairie Areas</li> <li>• Seed the A8P3 North Prairie Area</li> </ul>
IV	Fall 2005	<ul style="list-style-type: none"> <li>• Install trees and shrubs within the A8P3 North Forest Area</li> </ul>

Activities will be accelerated where possible. In addition to the above, soil sampling will be conducted as needed to determine the composition of soils within restoration areas. Most (if not all) of the restoration areas have intact topsoil, so the need for soil amendments is not anticipated. Field pH measurements have been taken in A8P3 South. Results of this effort indicate the need for lime application in several areas within the Willey Road and Substation Prairie Areas. Prior to seeding, lime will be applied via hydroseeding at a rate of 2000 pounds per acre.

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### 3.0 AREA-SPECIFIC DESCRIPTIONS

Each of the six restoration areas within A8PIII is discussed in more detail below. All forest areas are designed as a mesophytic forest template. Species that comprise the mesophytic template are listed in the Master Plant List (Table 3-1). All planting activities will be conducted according to the planting specifications (Appendix A). Prairie areas will be seeded in either upland mesic or wetland seed mixes. Forest areas will be seeded with an interim seed mix following plant installation. These species lists are provided in Table 3-2 through 3-4. Seed lists are consistent with the latest sitewide seeding specification (Appendix B).

#### 3.1 WILLEY ROAD FOREST AREA

The planting plan for the Willey Road Forest Area is shown in Figure 3-1. This area is a former floodplain of Paddys Run. The area presently consists of former grazed pasture, with a narrow strip of woody vegetation bordering Paddys Run to the west and a wooded slope to the east. The entire project area is visible from Willey Road to the south.

Forest restoration will focus on the expansion of the riparian corridor along Paddys Run. Since the area is not a floodplain, the mesophytic forest template is appropriate. Six patches will be established in the project area; three forest patches, a transition savanna patch that will consist primarily of seeded herbaceous vegetation, a vernal pool patch located around a small, excavated basin, and a woody understory/prairie edge patch that will be placed within the high-visibility wooded and open slope along Willey Road. The species lists and quantities for these patches are presented in Table 3-5.

Since the Willey Road Forest area is the first location to be restored, it will serve as a staging area for the remaining portions of A8PIII South. A gravel access and parking area will be constructed, along with a new gate. A mowed path from the gravel pad will serve as the main access point to the Willey Road Prairie Area.

#### 3.2 WILLEY ROAD PRAIRIE AREA

The Willey Road Area is also shown on Figure 3-1. The area sits on a terrace above the Paddys Run Stream Corridor. As with the other areas within A8PIII, this area is located around the perimeter of the FCP and was not used except for grazing cattle. Presently, the area is dominated with pasture grasses and forbs that ideally would be eliminated prior to prairie establishment. Following the removal of existing vegetation, the area will be seeded with an upland mesic prairie grass and forb list.

Several patches of woody vegetation will be planted within the eastern half of the prairie area. This savanna template will serve as a transition for the wooded corridor that borders the project area on the east. Species lists and quantities are shown in Table 3-5.

As Figure 1-1 shows, the Willey Road Prairie Area may be utilized as a reburial location for prehistoric Native American remains. If this location is chosen as the reburial site, then additional arrangements will be made regarding land use, identification markers, etc. Preliminary discussions with several Native American Tribes have revealed that any on-property reburial would be compatible with restoration activities such as prairie establishment and maintenance.

### 3.3 SUBSTATION FOREST AREA

The planting plan for the Substation Forest Area is shown in Figure 3-2. This area is similar to the Willey Road Forest area discussed above, except that there is a higher density of existing woody vegetation across the project area. Forest Patch No. 1 is more of a woodland community, so the planting patch list has been adjusted to increase the number of shade tolerant understory species for this area. Table 3-6 presents the patch-specific planting lists for the Substation Forest Area.

In addition to the four mesophytic forest patches, two small herbaceous patches will be established to enhance microhabitats created by the site hydrology. Herbaceous Patch No. 1 is in response to two groundwater seeps located on the side of the slope that separates the forest area from the prairie area. Herbaceous Patch No. 2 is located at the base of a small gully, where channelized surface water flow dissipates into sheet flow. These two areas present an opportunity to create several small wetland communities. Presently, some sedges (*Carex* spp.) and spikerush (*Eleocharis* spp.) are present, but the dominant vegetation is pasture grass. Planting activities in these two patches will focus on enhancing the existing wetland vegetation. The plant list for these areas is provided in Table 3-7.

### 3.4 SUBSTATION PRAIRIE AREA

The Substation Prairie Area is also shown in Figure 3-2. This area is similar to the Willey Road Prairie Area. A stand of trees from an old home site bisects the prairie into a northern and southern portion. Several savanna patches will be incorporated into the project area. Species and quantities are shown on Table 3-6.

### 3.5 A8P3III NORTH FOREST AREA

The planting plan for the A8P3III North Forest Area is shown in Figure 3-3. This area extends from a former floodplain area that is similar to the two forest areas in A8P3III South to a high cut bank that has always been outside of the Paddys Run flood zone. A wooded riparian corridor in A8P3III North is very narrow and even non-existent in some stretches. Therefore, as Figure 3-3 shows, the planting plan for A8P3III North is designed to expand the forested riparian corridor along Paddys Run. Table 3-8 provides the patch-specific planting lists for A8P3III North. Patch No. 2 and a portion of Patch No. 4 will be more densely planted than the other three patches, in response to the lack of any existing woody vegetation in these areas.

### 3.6 A8P3III NORTH PRAIRIE AREA

The A8P3III North Prairie Area is shown in Figure 3-3. This area is similar in description to the other A8P3III prairie areas, except that portions of the former grazed pasture exhibit hydric characteristics. It is suspected that the project area has been extensively drain tiled. Therefore, unlike the prairie areas in A8P3III South, this prairie will be a combination of upland mesic and wetland seeded areas. Wet areas will be determined following an attempt to plug drain tiles across the project area.

The portion of the A8P3III North Prairie Area may also be used as a reburial location, similar to the Willey Road Prairie Area. In addition, an existing prehistoric cultural resource site is located just south of the prairie area. The general location of the site is shown on Figures 1-2 and 3-3. The site boundaries are delineated, and restoration activities have been designed to avoid this area. Any field changes must avoid disturbance to this area as well.

TABLE 3-1  
AREA 8, PHASE III RESTORATION MASTER PLANT LIST

## SAPLINGS

ID	Species	Common Name	Form	Function	Coefficient of Wetness	Phase 1 Fall 2003	Phase 2 Fall 2004	Phase 3 Spring 2005	Total
A	<i>Acer rubrum</i>	Red Maple	canopy	cover	0	16	34	34	84
B	<i>Acer saccharinum</i>	Silver Maple	canopy	cover	-3	3	6	6	15
C	<i>Acer saccharum</i>	Sugar Maple	canopy	cover, mast	4	160	318	320	798
D	<i>Carya cordiformis</i>	Bitternut Hickory	canopy	cover	2	25	50	51	126
E	<i>Carya laciniosa</i>	Shellbark Hickory	canopy	cover, mast	0	28	57	56	141
F	<i>Carya ovata</i>	Shagbark Hickory	canopy	cover, mast	4	4	10	10	24
G	<i>Fagus grandifolia</i>	Beech	canopy	cover, mast	3	65	132	130	327
H	<i>Fraxinus americana</i>	White Ash	canopy	cover	3	20	39	40	99
I	<i>Fraxinus pennsylvanicum</i>	Green Ash	canopy	cover	-3	7	12	14	33
J	<i>Fraxinus quadrangulata</i>	Blue Ash	canopy	cover, diversity	ni	1	3	2	6
K	<i>Gymnocladus dioica</i>	Kentucky Coffeetree	canopy	diversity	ni	1	2	1	4
L	<i>Juglans cinerea</i>	Butternut	canopy	diversity	2	2	4	6	12
M	<i>Juglans nigra</i>	Black Walnut	canopy	diversity, mast	3	16	32	30	78
N	<i>Liriodendron tulipifera</i>	Tulip Poplar	canopy	cover, aesthetics	3	3	6	6	15
O	<i>Prunus serotina</i>	Black Cherry	canopy	fruit	3	11	21	22	54
P	<i>Quercus alba</i>	White Oak	canopy	cover, mast	4	41	80	80	201
Q	<i>Quercus bicolor</i>	Swamp White Oak	canopy	cover, mast	-4	11	22	21	54
R	<i>Quercus coccinea</i>	Scarlet Oak	canopy	cover, mast	ni	3	6	6	15
S	<i>Quercus inbricaria</i>	Shingle Oak	canopy	diversity, mast	0	3	5	4	12
T	<i>Quercus macrocarpa</i>	Bur Oak	canopy	diversity, mast	1	65	130	129	324
U	<i>Quercus muhlenbergii</i>	Chinquapin Oak	canopy	diversity, mast	0		2	1	3
V	<i>Quercus palustris</i>	Pin Oak	canopy	cover	-3	3	6	6	15
W	<i>Quercus prinus</i>	Chestnut Oak	canopy	diversity	5	1	1	1	3
X	<i>Quercus rubra</i>	Northern Red Oak	canopy	cover, mast	4	33	66	66	165
Y	<i>Quercus shumardii</i>	Shumard Oak	canopy	diversity, mast	-1	3	7	8	18
Z	<i>Quercus velutina</i>	Black Oak	canopy	cover, mast	ni	4	9	8	21
AA	<i>Tilia americana</i>	Basswood	canopy	cover, aesthetics	3	8	16	15	39
AB	<i>Ulmus rubra</i>	Slippery Elm	canopy	cover	0	1	2	3	6
AC	<i>Aesculus glabra</i>	Ohio Buckeye	understory	diversity	2	2	3	4	9
AD	<i>Asimina triloba</i>	Pawpaw	understory	fruit, diversity	2	4	9	9	22
AE	<i>Carpinus caroliniana</i>	American Hornbeam	understory	diversity, mast	0	18	37	38	93
AF	<i>Cercis canadensis</i>	Redbud	understory	cover, aesthetics, edge	4	5	10	10	25
AG	<i>Cornus alternifolia</i>	Alternate-leaf Dogwood	understory	cover, diversity	ni	2	3	4	9
AH	<i>Cornus drummondii</i>	Roughleaf Dogwood	understory	cover, edge	0	2	4	5	11
AI	<i>Cornus florida</i>	Flowering Dogwood	understory	aesthetics	4	5	10	12	27
AJ	<i>Cornus racemosa</i>	Gray Dogwood	understory	cover	ni	14	28	26	68
AK	<i>Crateagus crus-galli</i>	Cockspur Hawthorne	understory	cover, diversity	ni	3	6	6	15
AL	<i>Crateagus mollis</i>	Downy Hawthorne	understory	cover	3	2	4	4	10
AM	<i>Ostrya virginiana</i>	Hop-Hornbeam	understory	diversity	4	19	37	38	94
AN	<i>Prunus americana</i>	American Plum	understory	diversity	4	11	21	22	54
AO	<i>Sassafras albidum</i>	Sassafras	understory	diversity	4	1	2	2	5
AP	<i>Alnus serrulata</i>	Smooth Alder	shrub	erosion	-5	1			1
AQ	<i>Amelanchier arborea</i>	Downy Serviceberry	shrub	fruit, aesthetics	1	3	8	8	19
AR	<i>Amorpha fruticosa</i>	False Indigo Bush	shrub	cover, aesthetics	-3	3	6	5	14
AS	<i>Ceanothus americanus</i>	New Jersey Tea	shrub	diversity	ni	1	2	2	5
AT	<i>Celastrus scandens</i>	Bittersweet	shrub	diversity	4	6	12	11	29
AU	<i>Cephalanthus occidentalis</i>	Buttonbush	shrub	cover, erosion	-5	5	6	6	17
AV	<i>Cornus amomum</i>	Silky Dogwood	shrub	cover, erosion	-3	3	6	6	15
AW	<i>Corylus americana</i>	Hazelnut	shrub	diversity	4	4	7	8	19
AX	<i>Hamamelis virginiana</i>	Witch Hazel	shrub	cover	1	23	46	44	113
AY	<i>Hypericum spathulatum</i>	Shrubby St. John's Wort	shrub	diversity	3	5	10	10	25
AZ	<i>Ilex verticillata</i>	Winterberry	shrub	aesthetics	-4	2	5	6	13
BA	<i>Lindera benzoin</i>	Spicebush	shrub	cover	-2	12	24	24	60
BB	<i>Physocarpus opulifolius</i>	Ninebark	shrub	diversity, edge	-2	4	7	8	19
BC	<i>Rhus aromatica</i>	Fragrant Sumac	shrub	cover, aesthetics	ni	5	12	10	27
BD	<i>Rhus glabra</i>	Smooth Sumac	shrub	aesthetics, edge	ni	5	11	11	27
BE	<i>Rhus typhina</i>	Staghorn Sumac	shrub	aesthetics	ni	17	36	34	87
BF	<i>Rosa caroliniana</i>	Carolina Rose	shrub	aesthetics	5	9	18	16	43
BG	<i>Rosa palustris</i>	Swamp Rose	shrub	aesthetics	-5	1	2	2	5
BH	<i>Rosa setigera</i>	Prairie Rose	shrub	diversity	3	17	34	36	87

TABLE 3-1  
AREA 8. PHASE III RESTORATION MASTER PLANT LIST

ID	Species	Common Name	Form	Function	Coefficient of Wetness	Phase 1 Fall 2003	Phase 2 Fall 2004	Phase 3 Spring 2005	Total
BI	<i>Rubus occidentalis</i>	Black Raspberry	shrub	fruit, edge	ni	9	18	16	43
BJ	<i>Salix discolor</i>	Pussy Willow	shrub	cover, edge	-3	1	2	2	5
BK	<i>Sambucus canadensis</i>	Elderberry	shrub	erosion, fruit	-2	24	46	47	117
BL	<i>Spirea alba</i>	Meadowsweet	shrub	diversity	-4	2	2	4	8
BM	<i>Staphylea trifolia</i>	Bladdernut	shrub	diversity	0	2	13	13	28
BN	<i>Symphoricarpos orbiculatus</i>	Coralberry	shrub	diversity	5	18	38	37	93
BO	<i>Viburnum acerifolium</i>	Mapleleaf Viburnum	shrub	diversity, edge	5	10	20	19	49
BP	<i>Viburnum prunifolium</i>	Blackhaw Viburnum	shrub	cover	3	17	34	34	85
BQ	<i>Zanthoxylum americanum</i>	Prickly Ash	shrub	diversity, edge	ni	2	4	4	10
BR	<i>Campsis radicans</i>	Trumpet Creeper	vine	aesthetics, edge	0	5	9	10	24
					<b>Total</b>	<b>842</b>	<b>1,690</b>	<b>1,689</b>	<b>4,221</b>
<b>SEEDLINGS</b>									
B	<i>Acer saccharinum</i>	Silver Maple	canopy	cover	-3	40	80	80	200
C	<i>Acer saccharum</i>	Sugar Maple	canopy	cover, mast	4	384	768	768	1920
D	<i>Carya cordiformis</i>	Bitternut Hickory	canopy	cover	2	40	80	80	200
E	<i>Carya laciniosa</i>	Shellbark Hickory	canopy	cover, mast	0	40	80	80	200
F	<i>Carya ovata</i>	Shagbark Hickory	canopy	cover, mast	4	40	80	80	200
G	<i>Fagus grandifolia</i>	Beech	canopy	cover, mast	3	168	336	336	840
H	<i>Fraxinus americana</i>	White Ash	canopy	cover	3	72	144	144	360
M	<i>Juglans nigra</i>	Black Walnut	canopy	diversity, mast	3	96	192	192	480
N	<i>Liriodendron tulipifera</i>	Tulip Poplar	canopy	cover, aesthetics	3	40	80	80	200
O	<i>Prunus serotina</i>	Black Cherry	canopy	fruit	3	40	80	80	200
P	<i>Quercus alba</i>	White Oak	canopy	cover, mast	4	120	240	240	600
X	<i>Quercus rubra</i>	Northern Red Oak	canopy	cover, mast	4	120	240	240	600
					<b>Total</b>	<b>1,200</b>	<b>2,400</b>	<b>2,400</b>	<b>6,000</b>

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TABLE 3-2  
UPLAND MESIC PRAIRIE SEED MIX

Species	Pounds Per Acre (lb/ac)
Big Bluestem ( <i>Andropogon gerardi</i> )	
Little Bluestem ( <i>Andropogon scopariu</i> )	
Side-Oats Grama ( <i>Bouteloua curtipendula</i> )	
Indian Grass ( <i>Sorghastrum nutans</i> )	
Canada Wild-Rye ( <i>Elymus canadensis</i> )	
Switch grass ( <i>Panicum virgatum</i> )	
ReGreen (n/a)	
Wildflowers, uniform mix of the following:	
Butterflyweed ( <i>Asclepias tuberosa</i> )	
Smooth Aster ( <i>Aster laevis</i> )	
Ox-eye Sunflower ( <i>Heliopsis helianthoides</i> )	
Bergamot ( <i>Monarda fistulosa</i> )	
Purple Coneflower ( <i>Echinacea purpurea</i> )	
Black-Eyed Susan ( <i>Rudbeckia hirta</i> )	
Spiderwort ( <i>Tradescantia ohioensis</i> )	
Hoary Vervain ( <i>Verbena stricta</i> )	
Beardtongue ( <i>Penstemon grandiflorus</i> )	
Sweet Joe Pye-Weed ( <i>Eupatorium purpureum</i> )	
Blue False Indigo ( <i>Baptisia australis</i> )	
Partridge Pea ( <i>Cassia fasciculata</i> )	
Round-headed Bush Clover ( <i>Lespedeza Capitata</i> )	
Rattlesnake Master ( <i>Eryngium yuccifolium</i> )	
Stiff Goldenrod ( <i>Solidago rigida</i> )	
Boneset ( <i>Eupatorium perfoliatum</i> )	

TABLE 3-3  
WETLAND SEED MIX

Species	Pounds Per Acre (lb/ac)
Big Bluestem ( <i>Andropogon gerardi</i> )	3.0
Canada Wild-Rye ( <i>Elymus canadensis</i> )	25
Virginia Wild-Rye ( <i>Elymus virginicus</i> )	5.0
Switch Grass ( <i>Panicum virgatum</i> )	0.5
Blue Joint Grass ( <i>Calamagrostis canadensis</i> )	0.5
Porcupine Sedge ( <i>Carex hystericina</i> )	1 ounce per acre (oz/ac)
Fox Sedge ( <i>Carex vulpinoidea</i> )	1 ounce per acre (oz/ac)
Dark Green Bulrush ( <i>Scirpus atrovirens</i> )	1 ounce per acre (oz/ac)
ReGreen (n/a)	5.0
Prairie Cordgrass ( <i>Spartina pectinata</i> )	1.0
Wildflowers, uniform mix of the following:	1.5
Red Milkweed ( <i>Asclepias incarnata</i> )	
New England Aster ( <i>Aster novae-angliae</i> )	
Wild Senna ( <i>Cassia hebecarpa</i> )	
Great Blue Lobelia ( <i>Lobelia siphilitica</i> )	
Boneset ( <i>Eupatorium perfoliatum</i> )	
Blue Vervain ( <i>Verbena hastata</i> )	
Spotted Joe-Rye Weed ( <i>Eupatorium maculatum</i> )	
Cardinal Flower ( <i>Lobelia cardinalis</i> )	
Sawtooth sunflower ( <i>Helianthus grosseserratus</i> )	

**TABLE 3-4**  
**INTERIM SEED MIX**

Species	Pounds Per Acre (lb/ac)
ReGreen ( <i>n/a</i> )	40
Annual Rye Grass ( <i>Lolium multiflorum</i> )	20
Canada Wild Rye ( <i>Elymus canadensis</i> )	20
Partridge Pea ( <i>Cassia fasciculata</i> )	2 oz./Acre
Black-Eyed Susan ( <i>Rudbeckia hirta</i> )	2 oz./Acre



TABLE 3-5  
WILLEY ROAD FOREST RESTORATION AREA

ID	Species	Common Name	Phase 1 Quantity	Phase 2 Quantity	Patch 1 2.0 acres	Patch 2 1.25 acres	Patch 3 1.0 acre	Prairie Transition Area 1.25 acres	Woodland Understory/ Prairie Edge 0.5 acre	Vernal Pool Area 0.25 acre	Willey Road Savanna Area 5 acres
A	<i>Acer rubrum</i>	Red Maple	16	4	10	6	4				
B	<i>Acer saccharinum</i>	Silver Maple	3	0						3	
C	<i>Acer saccharum</i>	Sugar Maple	160	38	100	60	38				
D	<i>Carya cordiformis</i>	Bitternut Hickory	25	5	15	10	5				
E	<i>Carya laciniata</i>	Shellbark Hickory	28	7	15	13	7				
F	<i>Carya ovata</i>	Shagbark Hickory	4	0		4					
G	<i>Fagus grandifolia</i>	Beech	65	22	40	25	22				
H	<i>Fraxinus americana</i>	White Ash	20	4	12	8	4				
I	<i>Fraxinus pennsylvanicum</i>	Green Ash	7	2	7		2				
J	<i>Fraxinus quadrangulata</i>	Blue Ash	1	0	1						
K	<i>Gymnocladus dioica</i>	Kentucky Coffeetree	1	0		1					
L	<i>Juglans cinerea</i>	Butternut	2	0		2					
M	<i>Juglans nigra</i>	Black Walnut	16	6	10	6	6				
N	<i>Liriodendron tulipifera</i>	Tulip Poplar	3	1		3	1				
O	<i>Prunus serotina</i>	Black Cherry	11	1	6	5	1				
P	<i>Quercus alba</i>	White Oak	41	20	26	5	5	10			15
Q	<i>Quercus bicolor</i>	Swamp White Oak	11	0	6					5	
R	<i>Quercus coccinea</i>	Scarlet Oak	3	1	2	1	1				
S	<i>Quercus inbricata</i>	Shingle Oak	3	0	2	1					
T	<i>Quercus macrocarpa</i>	Bur Oak	65	20	20	5	5	40			15
V	<i>Quercus palustris</i>	Pin Oak	3	0	2					1	
W	<i>Quercus prinus</i>	Chestnut Oak	1	0		1					
X	<i>Quercus rubra</i>	Northern Red Oak	33	6	13	20	6				
Y	<i>Quercus shumardii</i>	Shumard Oak	3	0	2	1					
Z	<i>Quercus velutina</i>	Black Oak	4	2	2	2	2				
AA	<i>Tilia americana</i>	Basswood	8	1	4	4	1				
AB	<i>Ulmus rubra</i>	Slippery Elm	1	0	1						
AC	<i>Aesculus glabra</i>	Ohio Buckeye	2	0	2						
AD	<i>Asimina triloba</i>	Pawpaw	4	0	4						
AE	<i>Carpinus caroliniana</i>	American Hornbeam	18	2	8	10	2				
AF	<i>Cercis canadensis</i>	Redbud	5	3	1	1	3		3		
AG	<i>Cornus alternifolia</i>	Alternate-leaf Dogwood	2	0		2					
AH	<i>Cornus drummondii</i>	Roughleaf Dogwood	2	0		1				1	
AI	<i>Cornus florida</i>	Flowering Dogwood	5	0					5		
AJ	<i>Cornus racemosa</i>	Gray Dogwood	14	5	10	4	5				
AK	<i>Crategeus crus-galli</i>	Cockspur Hawthorne	3	0	2	1					
AL	<i>Crategeus mollis</i>	Downy Hawthorne	2	0	1	1					
AM	<i>Ostrya virginiana</i>	Hop-Hornbeam	19	7	9	7	7		3		
AN	<i>Prunus americana</i>	American Plum	11	3	5	6	3				
AO	<i>Sassafras albidum</i>	Sassafras	1	0					1		
AP	<i>Alnus serrulata</i>	Smooth Alder	1	0	1						
AQ	<i>Amelanchier arborea</i>	Downy Serviceberry	3	3	1	1	3		1		
AR	<i>Amorpha fruticosa</i>	False Indigo Bush	3	6			3		3		
AS	<i>Ceanothus americanus</i>	New Jersey Tea	1	0	1						
AT	<i>Celastrus scandens</i>	Bittersweet	6	2	3	3	2				
AU	<i>Cephalanthus occidentalis</i>	Buttonbush	5	0						5	
AV	<i>Cornus amomum</i>	Silky Dogwood	3	0						3	
AW	<i>Corylus americana</i>	Hazelnut	4	2		4					2
AX	<i>Hamamelis virginiana</i>	Witch Hazel	23	6	15	3	6	5			
AY	<i>Hypericum spathulatum</i>	Shrubby St. John's Wort	5	10	2		10			3	
AZ	<i>Ilex verticillata</i>	Winterberry	2	0	2						
BA	<i>Lindera benzoin</i>	Spicebush	12	3	4	3	3		5		
BB	<i>Physocarpus opulifolius</i>	Ninebark	4	2	2	2	2				
BC	<i>Rhus aromatica</i>	Fragrant Sumac	5	2	3	2					2
BD	<i>Rhus glabra</i>	Smooth Sumac	5	3	2	3	3				
BE	<i>Rhus typhina</i>	Staghorn Sumac	17	6	9	5	3	3	3		
BF	<i>Rosa caroliniana</i>	Carolina Rose	9	3			3	6	3		
BG	<i>Rosa palustris</i>	Swamp Rose	1	0						1	
BH	<i>Rosa setigera</i>	Prairie Rose	17	14				17			14
BI	<i>Rubus occidentalis</i>	Black Raspberry	9	3				9			
BJ	<i>Salix discolor</i>	Pussy Willow	1	0				1			
BK	<i>Sambucus canadensis</i>	Elderberry	24	10	6	3	10			15	
BL	<i>Spiraea alba</i>	Meadowsweet	2	0	2						
BM	<i>Staphylea trifolia</i>	Bladdernut	2	3		2	3				
BN	<i>Symphoricarpos orbiculatus</i>	Coralberry	18	3	13	5	3				
BO	<i>Viburnum acerifolium</i>	Mapleleaf Viburnum	10	5	5	1			5		5
BP	<i>Viburnum prunifolium</i>	Blackhaw Viburnum	20	4	9	2		3	6		4
BQ	<i>Zanthoxylum americanum</i>	Prickly Ash	2	0	1	1					
BR	<i>Campsis radicans</i>	Trumpet Creeper	5	0	3	2					
Total trees			626	160	338	216	130	50	12	10	30
Total shrubs			219	90	84	42	54	47	26	27	27
Total			845	250	422	258	184	97	38	37	57

TABLE 3-6  
SUBSTATION FOREST RESTORATION AREA

ID	Species	Common Name	Quantity	Patch 1 0.75 acre	Patch 2 2.0 acre	Patch 3 1.5 acre	Patch 4 1.25 acre	Substation Savanna Area 3.0 acres
A	<i>Acer rubrum</i>	Red Maple	30		15	10	5	
B	<i>Acer saccharinum</i>	Silver Maple	6	3	3			
C	<i>Acer saccharum</i>	Sugar Maple	280	80	80	60	60	
D	<i>Carya cordiformis</i>	Bitternut Hickory	45		15	15	15	
E	<i>Carya laciniosa</i>	Shellbark Hickory	50	20	15	10	5	
F	<i>Carya ovata</i>	Shagbark Hickory	10		7	3		
G	<i>Fagus grandifolia</i>	Beech	110	35	50	15	10	
H	<i>Fraxinus americana</i>	White Ash	35	5	15	10	5	
I	<i>Fraxinus pennsylvanicum</i>	Green Ash	10	7	3			
J	<i>Fraxinus quadrangulata</i>	Blue Ash	3			3		
K	<i>Gymnocladus dioica</i>	Kentucky Coffetree	2		2			
L	<i>Juglans cinerea</i>	Butternut	4	2	2			
M	<i>Juglans nigra</i>	Black Walnut	26	6	10	5	5	
N	<i>Liriodendron tulipifera</i>	Tulip Poplar	5		2	3		
O	<i>Prunus serotina</i>	Black Cherry	20	5	5	5	5	
P	<i>Quercus alba</i>	White Oak	60	10	10	10	10	20
Q	<i>Quercus bicolor</i>	Swamp White Oak	22	12		10		
R	<i>Quercus coccinea</i>	Scarlet Oak	5		3	2		
S	<i>Quercus inbricaria</i>	Shingle Oak	5			2	3	
T	<i>Quercus macrocarpa</i>	Bur Oak	110	10	30	25	20	25
U	<i>Quercus muhlenbergii</i>	Chinquapin Oak	2		2			
V	<i>Quercus palustris</i>	Pin Oak	6	2		4		
W	<i>Quercus prinus</i>	Chestnut Oak	1		1			
X	<i>Quercus rubra</i>	Northern Red Oak	60	10	20	20	10	
Y	<i>Quercus shumardii</i>	Shumard Oak	7		3	4		
Z	<i>Quercus velutina</i>	Black Oak	7		4		3	
AA	<i>Tilia americana</i>	Basswood	15		5	5	5	
AB	<i>Ulmus rubra</i>	Slippery Elm	2	2				
AC	<i>Aesculus glabra</i>	Ohio Buckeye	3	3				
AD	<i>Asimina triloba</i>	Pawpaw	9	9				
AE	<i>Carpinus caroliniana</i>	American Hornbeam	35		20	10	5	
AF	<i>Cercis canadensis</i>	Redbud	7	3	4			
AG	<i>Cornus alternifolia</i>	Alternate-leaf Dogwood	3	3				
AH	<i>Cornus drummondii</i>	Roughleaf Dogwood	4			4		
AI	<i>Cornus florida</i>	Flowering Dogwood	10	5	3	2		
AJ	<i>Cornus racemosa</i>	Gray Dogwood	23	3	7	7	6	
AK	<i>Crateagus crus-galli</i>	Cockspur Hawthorne	6		3		3	
AL	<i>Crateagus mollis</i>	Downy Hawthorne	4		2	2		
AM	<i>Ostrya virginiana</i>	Hop-Hornbeam	30	5	5	10	10	
AN	<i>Prunus americana</i>	American Plum	18		6	6	6	
AO	<i>Sassafras albidum</i>	Sassafras	2	2				
AQ	<i>Amelanchier arborea</i>	Downy Serviceberry	5		3	2		
AS	<i>Ceanothus americanus</i>	New Jersey Tea	2					2
AT	<i>Celastrus scandens</i>	Bittersweet	10			5	5	
AU	<i>Cephalanthus occidentalis</i>	Buttonbush	6	6				
AV	<i>Cornus amomum</i>	Silky Dogwood	6	3		3		
AW	<i>Corylus americana</i>	Hazelnut	5		5			
AX	<i>Hamamelis virginiana</i>	Witch Hazel	40	10	10	10		10
AZ	<i>Ilex verticillata</i>	Winterberry	5			5		
BA	<i>Lindera benzoin</i>	Spicebush	21	15	3	3		
BB	<i>Physocarpus opulifolius</i>	Ninebark	5		5			
BC	<i>Rhus aromatica</i>	Fragrant Sumac	10		5	5		
BD	<i>Rhus glabra</i>	Smooth Sumac	8		5	3		
BE	<i>Rhus typhina</i>	Staghorn Sumac	30		15	10	5	
BF	<i>Rosa caroliniana</i>	Carolina Rose	15		5	5	5	
BG	<i>Rosa palustris</i>	Swamp Rose	2	2				
BH	<i>Rosa setigera</i>	Prairie Rose	20		5			15

TABLE 3-6  
SUBSTATION FOREST RESTORATION AREA

ID	Species	Common Name	Quantity	Patch 1 0.75 acre	Patch 2 2.0 acre	Patch 3 1.5 acre	Patch 4 1.25 acre	Substation Savanna Area 3.0 acres
BI	<i>Rubus occidentalis</i>	Black Raspberry	15		5	5	5	
BJ	<i>Salix discolor</i>	Pussy Willow	2		2			
BK	<i>Sambucus canadensis</i>	Elderberry	36	18	12	6		
BL	<i>Spirea alba</i>	Meadowsweet	2	2				
BM	<i>Staphylea trifolia</i>	Bladdernut	10		5	5		
BN	<i>Symphoricarpos orbiculatus</i>	Coralberry	35		14	11	10	
BO	<i>Viburnum acerifolium</i>	Mapleleaf Viburnum	15		5	5	5	
BP	<i>Viburnum prunifolium</i>	Blackhaw Viburnum	30	10			5	15
BQ	<i>Zanthoxylum americanum</i>	Prickly Ash	4		4			
BR	<i>Campsis radicans</i>	Trumpet Creeper	9		3	3	3	
total trees			1092	242	352	262	191	45
total shrubs			348	66	111	86	43	42
total			1440	308	463	348	234	87

## SEEDLINGS

B	<i>Acer saccharinum</i>	Silver Maple	80		50	20	10
C	<i>Acer saccharum</i>	Sugar Maple	610	100	200	160	150
D	<i>Carya cordiformis</i>	Bitternut Hickory	70		40	30	
E	<i>Carya laciniosa</i>	Shellbark Hickory	70	20		30	20
F	<i>Carya ovata</i>	Shagbark Hickory	80		80		
G	<i>Fagus grandifolia</i>	Beech	280	100	100	40	40
H	<i>Fraxinus americana</i>	White Ash	120	30	30	30	30
M	<i>Juglans nigra</i>	Black Walnut	150	30	45	45	30
N	<i>Liriodendron tulipifera</i>	Tulip Poplar	70		40	30	
O	<i>Prunus serotina</i>	Black Cherry	70		20	30	20
P	<i>Quercus alba</i>	White Oak	200	25	75	75	25
X	<i>Quercus rubra</i>	Northern Red Oak	200	25	75	75	25
total				330	755	565	350

TABLE 3-7  
SUBSTATION FOREST RESTORATION AREA HERBACEOUS PLANTS  
(2 in. x 2 in. plugs)

Species	Common Name	Quantity	Herbaceous Patch 1	Herbaceous Patch 2
<i>Carex vulpinoidea</i>	fox sedge	48	24	24
<i>Eupatorium maculatum</i>	spotted Joe pye weed	48	24	24
<i>Eupatorium perfoliatum</i>	boneset	48	24	24
<i>Filipendula rubra</i>	queen of the prairie	48	24	24
<i>Helianthes grossesserratus</i>	sawtooth sunflower	48	24	24
<i>Liatris spicata</i>	marsh blazingstar	48	24	24
<i>Lobelia siphilitica</i>	great blue lobelia	48	24	24

TABLE 3-8  
AREA 8, PHASE III NORTH RESTORATION AREA

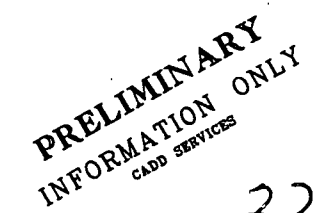
ID	Species	Common Name	Quantity	Patch 1 0.5 acre	Patch 2 0.75 acre	Patch 3 1.0 acre	Patch 4 1.25 acre	Patch 5 3.25 acre
A	<i>Acer rubrum</i>	Red Maple	34				10	24
B	<i>Acer saccharinum</i>	Silver Maple	6			6		
C	<i>Acer saccharum</i>	Sugar Maple	320	20	50	50	50	150
D	<i>Carya cordiformis</i>	Bitternut Hickory	51			15	15	21
E	<i>Carya laciniosa</i>	Shellbark Hickory	56	10		10	10	26
F	<i>Carya ovata</i>	Shagbark Hickory	10		10			
G	<i>Fagus grandifolia</i>	Beech	130	15	15	25	25	50
H	<i>Fraxinus americana</i>	White Ash	40		20	5	5	10
I	<i>Fraxinus pennsylvanicum</i>	Green Ash	14			4		10
J	<i>Fraxinus quadrangulata</i>	Blue Ash	2		2			
K	<i>Gymnocladus dioica</i>	Kentucky Coffetree	1	1				
L	<i>Juglans cinerea</i>	Butternut	6	3				3
M	<i>Juglans nigra</i>	Black Walnut	30		15			15
N	<i>Liriodendron tulipifera</i>	Tulip Poplar	6	2			2	2
O	<i>Prunus serotina</i>	Black Cherry	22			10	12	
P	<i>Quercus alba</i>	White Oak	80	20		20	20	20
Q	<i>Quercus bicolor</i>	Swamp White Oak	21			14		7
R	<i>Quercus coccinea</i>	Scarlet Oak	6	3	3			
S	<i>Quercus inbricaria</i>	Shingle Oak	4	2	2			
T	<i>Quercus macrocarpa</i>	Bur Oak	129	20	29	20	20	40
U	<i>Quercus muhlenbergii</i>	Chinquapin Oak	1		1			
V	<i>Quercus palustris</i>	Pin Oak	6					6
W	<i>Quercus prinus</i>	Chestnut Oak	1		1			
X	<i>Quercus rubra</i>	Northern Red Oak	66	10	10	10	10	26
Y	<i>Quercus shumardii</i>	Shumard Oak	8	3				5
Z	<i>Quercus velutina</i>	Black Oak	8			3		5
AA	<i>Tilia americana</i>	Basswood	15			5	5	10
AB	<i>Ulmus rubra</i>	Slippery Elm	3	3				
AC	<i>Aesculus glabra</i>	Ohio Buckeye	4	2				2
AD	<i>Asimina triloba</i>	Pawpaw	9	3			3	3
AE	<i>Carpinus caroliniana</i>	American Hornbeam	38	10			10	18
AF	<i>Cercis canadensis</i>	Redbud	10	3		2	3	
AG	<i>Cornus alternifolia</i>	Alternate-leaf Dogwood	4					4
AH	<i>Cornus drummondii</i>	Roughleaf Dogwood	5					5
AI	<i>Cornus florida</i>	Flowering Dogwood	12	3		3	3	3
AJ	<i>Cornus racemosa</i>	Gray Dogwood	26		10			16
AK	<i>Crateagus crus-galli</i>	Cockspur Hawthorne	6	3	3			
AL	<i>Crateagus mollis</i>	Downy Hawthorne	4					4
AM	<i>Ostrya virginiana</i>	Hop-Hornbeam	38			10	10	18
AN	<i>Prunus americana</i>	American Plum	22	2	10			10
AO	<i>Sassafras albidum</i>	Sassafras	2				2	
AQ	<i>Amelanchier arborea</i>	Downy Serviceberry	8	3				4
AR	<i>Amorpha fruticosa</i>	False Indigo Bush	5		5			
AS	<i>Ceanothus americanus</i>	New Jersey Tea	2		2			
AT	<i>Celastrus scandens</i>	Bittersweet	11	3				8
AU	<i>Cephalanthus occidentalis</i>	Buttonbush	6			6		
AV	<i>Cornus amomum</i>	Silky Dogwood	6			6		
AW	<i>Corylus americana</i>	Hazelnut	8					8
AX	<i>Hamamelis virginiana</i>	Witch Hazel	44		7	10	10	17
AY	<i>Hypericum spathulatum</i>	Shrubby St. John's Wort	10					10
AZ	<i>Ilex verticallata</i>	Winterberry	6	6				
BA	<i>Lindera benzoin</i>	Spicebush	24	3			7	14
BB	<i>Physocarpus opulifolius</i>	Ninebark	8		4	4		
BC	<i>Rhus aromatica</i>	Fragrant Sumac	10		5		5	

TABLE 3-8  
AREA 8, PHASE III NORTH RESTORATION AREA

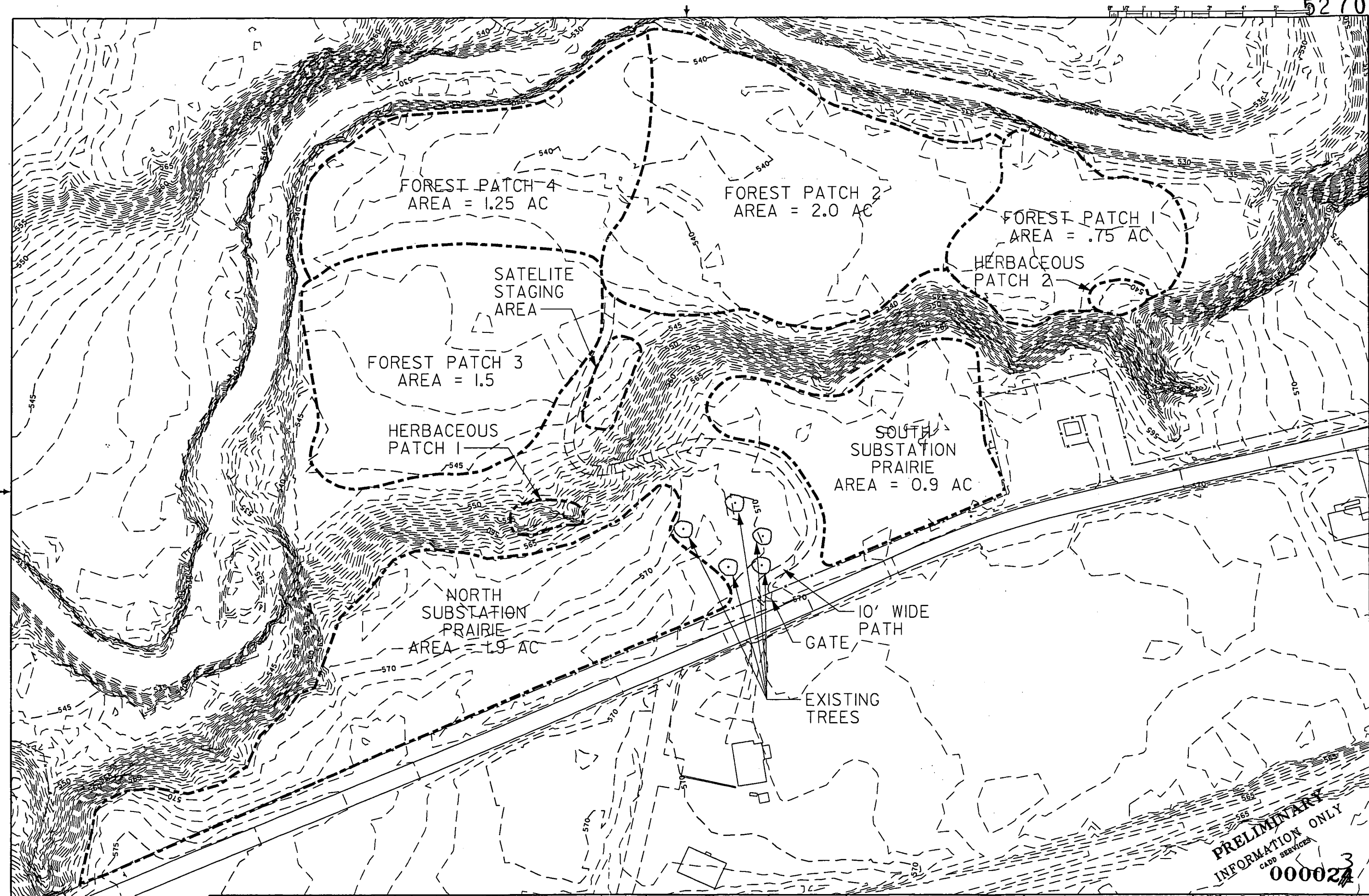
ID	Species	Common Name	Quantity	Patch 1 0.5 acre	Patch 2 0.75 acre	Patch 3 1.0 acre	Patch 4 1.25 acre	Patch 5 3.25 acre
BD	<i>Rhus glabra</i>	Smooth Sumac	11		5			6
BE	<i>Rhus typhina</i>	Staghorn Sumac	34			7	7	20
BF	<i>Rosa caroliniana</i>	Carolina Rose	16			6		10
BG	<i>Rosa palustris</i>	Swamp Rose	2			2		
BH	<i>Rosa setigera</i>	Prairie Rose	36				10	26
BI	<i>Rubus occidentalis</i>	Black Raspberry	16		6	10		
BJ	<i>Salix discolor</i>	Pussy Willow	2		2			
BK	<i>Sambucus canadensis</i>	Elderberry	47	10		10	7	20
BL	<i>Spirea alba</i>	Meadowsweet	4			4		
BM	<i>Staphylea trifolia</i>	Bladdernut	13	6				7
BN	<i>Symphoricarpos orbiculatus</i>	Coralberry	37		20		17	
BO	<i>Viburnum acerifolium</i>	Mapleleaf Viburnum	19	5		5	9	
BP	<i>Viburnum prunifolium</i>	Blackhaw Viburnum	34	4			15	15
BQ	<i>Zanthoxylum americanum</i>	Prickly Ash	4					4
BR	<i>Campsis radicans</i>	Trumpet Creeper	10					10
Total trees			1256	138	181	212	215	513
Total shrubs			433	40	56	70	87	179
Total			1,689	178	237	282	302	692

## SEEDLINGS

B	<i>Acer saccharinum</i>	Silver Maple	80			40		40
C	<i>Acer saccharum</i>	Sugar Maple	768	50	75	175	200	268
D	<i>Carya cordiformis</i>	Bitternut Hickory	80			20	20	40
E	<i>Carya laciniosa</i>	Shellbark Hickory	80	40		20	20	
F	<i>Carya ovata</i>	Shagbark Hickory	80		40	20	20	
G	<i>Fagus grandifolia</i>	Beech	336	36		50	100	150
H	<i>Fraxinus americana</i>	White Ash	144	20	20	20	44	40
M	<i>Juglans nigra</i>	Black Walnut	192	42	50			100
N	<i>Liriodendron tulipifera</i>	Tulip Poplar	80	20	20	20	20	
O	<i>Prunus serotina</i>	Black Cherry	80		20	20	20	20
P	<i>Quercus alba</i>	White Oak	240		60	60	60	60
X	<i>Quercus rubra</i>	Northern Red Oak	240		60	60	60	60
total			2,400	208	345	505	564	778



AREA 8, PHASE III SOUTH WILLEY ROAD FOREST RESTORATION PROJECT		FIGURE 3-1
DATE	06/26/03	
DRAWN	K.L. RABBITT	



PRELIMINARY  
INFORMATION ONLY  
CADD SERVICES  
000023

NO.	REVISIONS	DATE	OWN. BY	APPD. NO.	REVISIONS	DATE	OWN. BY	APPD. NO.	REF. DWG. NO.

NOTE:  
FLUOR FERNALD  
CADD DRAWING.  
DO NOT REVISE  
MANUALLY.

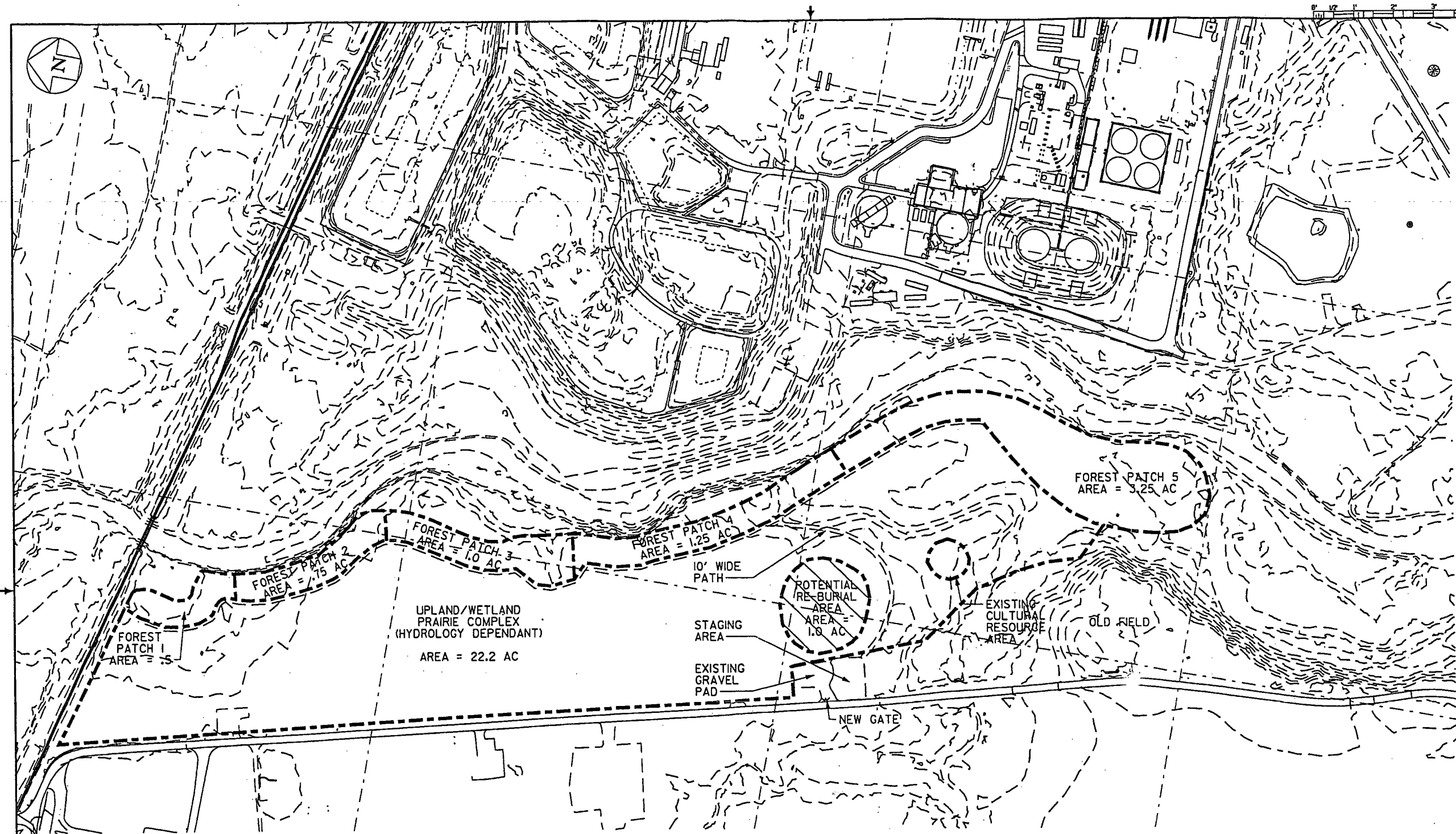
CONFIGURATION  
DRAWING  
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APPROVED

APPROVALS	DATE
CIVIL & STR.	
ELECTRICAL	
ENGINEER	
INSTRUMENT	
MECHANICAL	
SAFETY ENG.	
MAINTENANCE	
FIRE PROTECT.	
WASTE MNGT.	
SECURITY	
PROJECTS	

Fernald Closure Project  
FLUOR FERNALD, INC.  
U.S. DEPARTMENT OF ENERGY

AREA 8, PHASE III SOUTH  
SUBSTATION FOREST  
RESTORATION PROJECT  
PLANTING PLAN  
DATE 08/25/03  
DRAWN K.L. RABBITT  
FIGURE 3-2





 POTENTIAL RE-BURIAL SITE

NO.	REVISIONS	DATE	OWN. BY	APPD.	NO.	REVISIONS	DATE	OWN. BY	APPD.	REF. DWG. NO.

NOTE:  
FLUOR FERNALD  
CADD DRAWING.  
DO NOT REVISE  
MANUALLY.

CONFIRMATION  
DRAWING  
☐ YES  
☐ NO  
DATE: 06/28/03  
BY: E.L. RABBITT

APPROVALS	
CIVIL & STR.	SAFETY ENG.
ELECTRICAL	MAINTENANCE
ENGINEER	FIRE PROTECT.
INSTRUMENT	WASTE MANAGE.
MECHANICAL	SECURITY
PROJECTS	PROJECTS
CHECKED	APPROVED
DATE	DATE

Fernald Environmental  
Management Project  
**FLUOR FERNALD, INC.**  
U.S. DEPARTMENT OF ENERGY

PADDY'S RUN WEST RESTORATION  
AREA 8 PHASE III  
PLANTING PLAN  
DATE: 06/28/03  
DRAWN: E.L. RABBITT  
FIGURE 3-3

#### 4.0 FIELD IMPLEMENTATION

Field implementation of the A8PIII restoration areas is described below and in the attached planting and seeding specifications. Extensive grading and bioengineering for erosion control is not anticipated.

##### 4.1 SITE PREPARATION ACTIVITIES

As shown in Table 2-1, Site Preparation involves the establishment of access points and staging areas for the delivery of tools, equipment, materials, and planting stock. One gravel pad will be installed at the access point for the Willey Road Forest Area (Figure 3-1). This area will also serve as the main staging location for the Substation Forest Area and the two A8PIII South prairie areas. In A8PIII North, the gravel pad that was used in support of riprap installation west of the Silos will be improved and used during Phases II and III of restoration (Figure 3-3). Fluor Fernald construction personnel will install gates, access points, and gravel pads pursuant to Figure 3-3 and as directed by the construction manager.

Existing herbaceous vegetation within all prairie and planting areas will be killed using a glyphosphate herbicide. Licensed subcontract personnel will apply herbicide via a truck-mounted boom sprayer and/or a backpack sprayer. Seeding areas will be sprayed at least twice prior to seeding. Planting areas will be sprayed only once.

An attempt will be made to locate drain tiles across the A8PIII North Prairie Area. Tiles will either be located by hand or through the use of ground-penetrating radar.

##### 4.2 PLANTING ACTIVITIES

Planting activities involve the establishment of trees, shrubs, and herbaceous plants across the project area. All revegetation activities will be conducted pursuant to the densities documented in the NRRP. Densities for areas amenable to planting include 160 trees/acre, 90 shrubs/acre, and 400 seedlings/acre.

Woody plants will be installed in the same manner as other ecological restoration projects at the FCP. Habitat templates will be divided into smaller planting patches. Each planting patch will be laid out in the field and color-coded. The plants themselves will be staged at the project site and tagged with a corresponding colored patch code. Laborers would then simply match the plant/patch codes and install the plant pursuant to the planting specifications in Appendix A. This "random patch" method allows the restoration ecologist to strategically place specific species based on its habitat requirements, distribution patterns, exposure, topography, deer pressure, hydrology, soils, etc.

Bare-root seedlings will not be individually "flagged and tagged." Instead, the restoration ecologist will group the seedlings by patch and instruct the laborers to randomly distribute the seedlings within the patch area. Seedlings will also be installed pursuant to the specifications in Appendix A.

The use of herbaceous plants will be limited to several seeps on the slope between the Substation Prairie Area and Forest Area (Figure 3-2). Herbaceous plants will be delivered to the site in 2-inch square open-bottom pots. These plants must be staged by placing in water immediately upon arrival at the site. Herbaceous plant installation will be conducted using a dibble bar or shovel. Plants will be carefully removed from their pot and placed into the planting hole, keeping the root mass and soil ball intact. The plant is then gently pressed into place by hand. Laborers should make sure that no roots are exposed.

All plant material will be procured from local sources, if possible. All trees shall be at least one-gallon container size, grown in "spin out" containers to prevent root binding. Shrubs must also be grown in spin out containers, and must be at least 1 foot tall. Seedlings may be container-grown or bare root. Certain species may not be available locally, if at all. The restoration ecologist will determine the appropriate substitution for a plant. The function of the tree as listed in Table 3-1 will be used as a guide to determining substitutions. The Natural Resource Trustees will be notified of any substitutions as part of the consolidated monitoring program discussed in the NRRP.

All plant material will be delivered to the Southern Waste Units project area directly. A laydown area will be established adjacent to the mulch stockpile area, where plant material may be staged. Any plants that are stored for more than 24 hours at the staging area shall be healed in with woodchip mulch. Bare root seedlings shall be immediately removed from their packing materials and healed in or placed directly in water, in accordance with the vendor's directions. Live stakes will be installed as soon as possible upon receipt. Seed will be stored in a cool place until it can be applied to the project area.

#### 4.3 SEEDING ACTIVITIES

All prairie areas will be seeded pursuant to the seeding specification. As stated in Section 4.1 above, areas will be seeded following at least two applications of glyphosphate herbicide. All areas will be seeded in an upland mesic grass and forb mix, with the exception of several wet areas within the A8P3III North Prairie Area. A wet prairie grass and forb mix will be seeded within these areas. Wet areas will be determined following the plugging of agricultural drain tiles across the prairie area. Forest areas will be seeded with the interim cover mix pursuant to the attached specification (Appendix B). These areas will be broadcast seeded following plant installation.

#### 4.4 MAINTENANCE ACTIVITIES

Maintenance is critical to restoration success. Activities that will be required for A8PIII restoration areas include watering, deer control, and invasive species control. These activities are discussed in more detail below.

##### 4.4.1 Watering

Each plant will be watered at the time of installation. Pursuant to the attached specification, DOE will ensure that each plant receives an adequate amount of water each week, for the first six weeks after planting. Water is accessible to both planting areas within A8PIII South. In A8PIII North, polyethylene tanks may be used to provide water for planting areas. Watering will be carried out either directly via hose, tree gator and/or bucket, or remotely via water cannon. Water may be carried out during the second growing season if significant drought conditions occur similar to the summer of 1999. Under normal rainfall conditions, watering after the initial planting period will not be necessary.

For seeded areas, the planting window restrictions in the attached seeding specification help to ensure that sufficient soil moisture exists for germination and survival of seeds. Weather patterns will be a contributing factor in timing seed application.

##### 4.4.2 Deer Control

Installed trees and shrubs must be protected from deer browsing and rubbing in order for forest restoration efforts to be successful. At a minimum, field personnel will install deer tubes around all planted trees. In addition, a latex-based taste repellent will be applied to all plant material. These measures have proven to be moderately effective in past restoration efforts.

##### 4.4.3 Invasive Species

The forest restoration concept developed in the NRRP depends on ecological succession as primary component. Without adequate control, invasive species may impede succession and alter the intended course of maturation for restored areas. Therefore, field personnel will mechanically remove or apply glyphosphate herbicide to bush honeysuckle, multiflora rose, and grape vines present in A8PIII planting areas.

## 5.0 MONITORING

Both Implementation and Functional monitoring will be conducted for A8P3III restoration. For Implementation Phase Monitoring, plant survival and herbaceous cover are the only requirements. To facilitate plant survival evaluations, all sapling trees and shrubs will be tagged with a unique number, which will be recorded on patch-specific data sheets. Mortality counts will be conducted at the end of the first growing season following completion of each phase of restoration. (Phase III will not be included in Implementation Phase Monitoring, since the growing season following installation is beyond site closure.) For Implementation Monitoring of seeded areas, herbaceous cover will be evaluated pursuant to the process and criteria set forth in the 2002 Consolidated Monitoring Report (DOE 2003).

Functional Monitoring will also commence following restoration of each phase. In accordance with the current Functional Monitoring schedule, completed prairie areas will be evaluated in 2004 and completed forest areas will be evaluated in 2005. As with Implementation Monitoring, methods, results, analyses, and reporting are conducted under the Consolidated Monitoring Report.

## REFERENCES

U.S. Department of Energy, 2002, "Natural Resource Restoration Plan," Final, Fernald Environmental Management Project, DOE, Fernald Area Office, Cincinnati, Ohio.

U.S. Department of Energy, 2003, "2002 Consolidated Monitoring Report for Restored Areas at the Fernald Closure Project," Draft, Fernald Closure Project, DOE, Fernald Area Office, Cincinnati, Ohio.

**APPENDIX A**

**PLANTING SPECIFICATIONS**

**SECTION 02940****PLANTING****PART 1 GENERAL****1.1 SCOPE**

- A. This Section includes the requirements for planting trees, shrubs, and herbaceous potted plants as shown on the Construction Drawings.

**1.2 RELATED SECTIONS AND DOCUMENTS**

- A. Section 02930 - Vegetation.

**PART 2 PRODUCTS****2.1 MATERIALS**

- A. Container grown trees shall be a minimum of 6 feet in height, grown in "spin-out" containers and acquired from a local seed source if possible. Potting material shall be pre-inoculated with mycorrhizae.
- B. Container-grown shrubs shall be a minimum of 1 foot in height, grown in "spin-out" containers and acquired from a local seed source if possible. Potting material shall be pre-inoculated with mycorrhizae.
- C. Bareroot seedlings shall be pre-inoculated with ecto-mycorrhizae and shall not be exposed to the air any longer than possible prior to planting.
- D. Herbaceous potted plants shall be grown in open bottom, minimum 2-inch square and 3-inch deep containers. Potting material shall be inoculated with ecto-mycorrhizae.
- E. Fertilizer shall be slow-release tablet form, and not exceed a N-P-K mix of 22-5-10. Fertilizer shall contain not less than 1 percent added sulfur and not more than 8 percent added iron, or an approved equal.
- F. Mulch shall be an aged hardwood mulch, free of clay, stone, foreign substances, and free of weeds.
- G. Compost shall be mature and stable, as determined by the U.S. Compost Council Seal of Testing Assurance program.
- H. Wooden stakes for staking trees as needed shall be nominal 1 inch square, approximately 5 feet in length.

**2.2 EQUIPMENT**



- A. Equipment for performing work in this section shall be low ground pressure equipment that will not compact amended soils. Equipment shall not exceed 6.0 psi.

### **PART 3 EXECUTION**

#### **3.1 GENERAL**

- A. The Restoration Ecologist will flag planting locations in the field. The Restoration Ecologist is the Fluor Fernald contact responsible for identifying locations of all plant material installation, verifying acceptance of delivered plant material, and ensuring proper installation.
- B. Unless otherwise approved by the Restoration Ecologist, all plant installation shall take place between October 1 and December 15 or February 15 and May 15.
- C. The Restoration Ecologist may restrict planting activities based on field conditions (e.g., droughts, unseasonable freezes).
- D. No plant installation may take place while the soil surface is saturated or frozen.
- E. Plant material delivered to the project site that will not be planted within 24 hours shall have their containers completely covered with woodchip mulch and kept moist with periodic watering.
- F. The Construction Manager will provide a source of water sufficient to support all field activities specified in this Section.

#### **3.2 INSTALLATION OF CONTAINER-GROWN TREES AND SHRUBS (DETAIL A-1)**

- A. Excavate planting pit to a depth such that the top of the ball, when planted, extends 1 to 2 inches above ground surface.
- B. Excavate the planting pit so that it is wider than the root ball by at least 9 inches on all sides.
- C. Scarify the sides of the planting pit using a shovel.
- D. Remove the plant from the container by carefully inverting the plant and loosening the root ball from the container, cutting the container if necessary. Keep the root ball as intact as possible. Handle the plant by the root ball only. Do not pull the plant from the container by the trunk of the tree or shrub.
- E. Add a slow-release fertilizer tablet or packet (e.g., Osmocote, Agriform or similar) or systemic fertilizer/deer repellent tablet around the ball per manufacturers recommendations.

- F. Set trees and shrubs such that the top of the ball extends 1 to 2 inches above the ground surface and that the trunk is vertical. Trunks shall have no appreciable lean, at the discretion of the Restoration Ecologist.
- G. Backfill around the root ball with a mixture of the topsoil or compost soil amendment and subsoil removed from the pit. Gently tamp the backfill as it is placed into the pit.
- H. Water the tree/shrub immediately after planting to saturate the upper 12 inches of soil.
- I. Remove any tags, labels, strings or wires from the plant, unless otherwise directed by the Restoration Ecologist.

### 3.3 INSTALLATION OF BAREROOT PLANTS (DETAIL A-2)

- A. Carry bareroot plants in a bucket of water (or moist sand or other moist medium) in the field to keep the roots from drying out. Bareroot plants shall not be stored in water for more than 6 hours at a time. Bareroot plants that require overnight storage shall have their root balls covered completely with moist hardwood mulch and kept moist with periodic watering.
- B. Excavate the planting pit by hand using a dibble bar or spade. The pit shall be only broad enough to accommodate the roots when fully extended and only deep enough such that the uppermost roots will be just below ground surface.
- C. Set the plant and spread the roots in a natural pattern such that the roots are fully extended without touching the sides of the planting pit and that the uppermost roots are just below ground surface.
- D. Carefully work backfill (mix of topsoil and subsoil removed from the planting pit) through the fully spread root systems and water while backfilling.
- E. Firmly tamp backfill with the heel of the shoe when complete.
- F. Remove any tags, labels, and strings from the plant, unless otherwise directed by the Restoration Ecologist.

### 3.4 INSTALLATION OF HERBACEOUS POTTED PLANTS

- A. Place potted plant flats in standing water immediately upon delivery to the project site. Keep flats in water until installation unless otherwise directed by the Restoration Ecologist.
- B. Excavate the planting pit by hand using a dibble bar, spade, or auger. The pit shall be only broad enough to accommodate the roots when fully extended and only deep enough such that the uppermost roots will be just below ground surface.
- C. Set the plant and spread the roots in a natural pattern such that the roots are fully extended without touching the sides of the planting pit and that the uppermost roots are just below ground surface.

- D. Carefully work backfill (mix of topsoil and subsoil removed from the planting pit) through the fully spread root systems and water while backfilling.
- E. Firmly tamp backfill with the heel of the shoe when complete.
- F. Remove any tags, labels, and strings from the plant, unless otherwise directed by the Restoration Ecologist.

### **3.5 PRUNING**

- A. Once trees and shrubs are planted, prune off any dead or damaged limbs.
- B. All pruning shall involve removal of limbs back to a lateral branch or bud.
- C. Perform additional pruning at the request of the Restoration Ecologist.

### **3.6 MULCHING**

- A. Apply a 4-inch layer of hardwood mulch over a circular area 4 feet in diameter surrounding balled and burlapped and container grown trees and shrubs. At the discretion of the Restoration Ecologist, straw may be used as a substitute for hardwood mulch.
- B. Apply a 4-inch layer of hardwood mulch over a circular area 2 feet in diameter surrounding each bare root or potted plant. At the discretion of the Restoration Ecologist, straw may be used as a substitute for hardwood mulch.
- C. Mulch shall be placed so as to not physically contact the plants.

### **3.7 WATERING**

- A. Water all planted material weekly for 6 weeks following installation, unless otherwise directed by the Restoration Ecologist. Watering shall be sufficient to saturate the entire root ball. This typically requires the slow release of approximately 10 gallons of water for each plant.

### **3.8 STAKING AND GUYING**

- A. Stake and guy trees only at the request of the Restoration Ecologist.

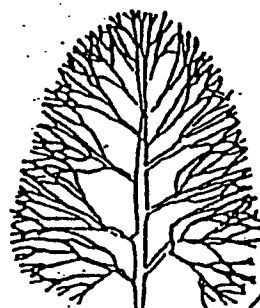
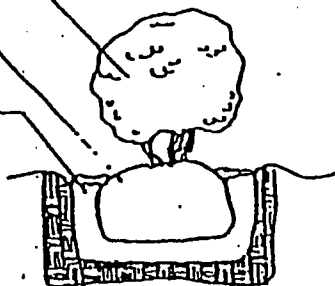
END OF SECTION

Detail A-1: Installation of Balled and Burlapped and Container-Grown Trees and Shrubs

SHRUB SET VERTICAL  
WITH NO MORE THAN  
10% LEAN

BALL SET SO THAT  
ITS TOP IS APPROX.  
1-2" ABOVE SOIL LINE

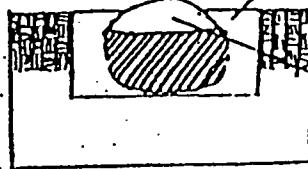
PLANTING PIT EXCAVATED  
9" WIDER THAN BALL  
ON ALL SIDES



TRUNK SET VERTICAL  
WITH NO MORE THAN  
10% LEAN

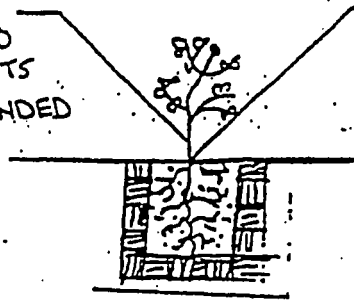
PLANTING PIT EXCAVATED  
9" WIDER THAN BALL ON  
ALL SIDES

BALL SET SO THAT  
ITS TOP IS APPROXIMATELY  
1-2" ABOVE SOIL LINE



**Detail A-2: Installation of Bareroot Plants**

PLANTING POT  
LARGE ENOUGH TO  
ACCOMMODATE ROOTS  
IN A FULLY EXTENDED  
POSITION



SET PLANT SUCH  
THAT UPPER MOST  
ROOTS ARE JUST  
BELOW THE SOIL  
SURFACE

**APPENDIX B**

**SEEDING AND BIOENGINEERING EROSION  
CONTROL SPECIFICATIONS**

**SECTION 02930****VEGETATION****PART 1 GENERAL****1.01 SCOPE**

- A. This Section includes soil stabilization, which includes application of crusting agent and establishing vegetation by seeding. The work in this Section includes, but is not limited to; soil preparation, interim vegetation, permanent vegetation, application of fertilizer, application of mulches, and application of crusting agent.

**1.02 RELATED SECTIONS AND PLANS**

- A. Section 02200 - Earthwork
- B. Section 02270 - Surface-Water Management and Erosion Control
- C. Part 6 - Statement of Work
- D. Part 8 - Environmental Health & Safety/Training Requirements
- E. Part 9 - Quality Assurance Requirements

**1.03 REFERENCES**

- A. Latest version of Ohio Department of Natural Resources (ODNR) Rainwater and Land Development Standards (ODNR Rainwater and Land Development Standards).
- B. *"Identification and Listing of Hazardous Waste"*, Title 40, Code of Federal Regulations (CFR), Part 261, Subpart E.C.
- C. *"Federal Hazardous Material Transportation Law"*, U.S. Department of Transportation [U.S. DOT, 1994].

**1.04 SUBMITTALS**

- A. Submit the following to the Construction Manager for review at least 15 calendar days from Notice to Proceed:
  - 1. Proposed mixes and application rates for seed, mulch, fertilizers, and crusting agents;

2. Manufacturer's product data and recommended methods of application for seed, mulches, fertilizer, and crusting agents;
  3. Product data for fertilizer shall also include chemical analysis including uranium analysis to assure there is no resultant or derived uranium from fertilizer use, unless waived by Construction Manager;
  4. Material safety data sheet (MSDS) for fertilizer, mulch binder and crusting agent; and
  5. Inoculant information for the permanent seed mixes.
- B. Submit the following to the Construction Manager for review at least 30 calendar days before seeding:
1. Certificate stating seed mixture, guaranteed percentages of purity, weed content, germination of seed, name of seller, test date for the seed, and the net weight and date of shipment;
  2. Manufacturer's certificate stating the available nutrients contained in the proposed fertilizer;
  3. Manufacturer's certificate stating that the fiber matrix (wood fibers) meets the requirements of this Section;
  4. Manufacturer's certificate stating the mulch binder meets the requirements of this Section;
  5. Manufacturer's certificate stating the crusting agent meets the requirements of this Section; and
  6. Documentation of the straw to be used for mulch; this documentation shall verify that the straw is weed free in accordance with the requirements of this Section.
- C. Submit to the Construction Manager for review at least 10 calendar days before seeding a plan showing seeding area and a written statement of application rate of seed mix and/or associated materials (i.e., fertilizer, mulch, and mulch binder). Choice of seeding type shall follow the site seeding requirements and as approved by the Construction Manager.
- D. Provide a list of equipment, description of construction methods, and other required information for vegetation and application of crusting agent in the Contractor's Earthwork Work Plan specified in Section 02200.

## 1.05 HEALTH AND SAFETY REQUIREMENTS

- A. Environmental health & safety/training requirements shall be in accordance with Part 8 of the Contract Documents.



**1.06 CONTRACTOR'S QUALITY ASSURANCE**

- A. Contractor's quality assurance requirements shall be in accordance with Part 9 of the Contract Documents.

**PART 2 PRODUCTS****2.01 MATERIALS**

- A. Furnish seed labeled in accordance with U.S. Department of Agriculture (USDA) Rules and Regulations under the Federal Seed Act and applicable State seed laws. Furnish seed in sealed bags or containers bearing the date of expiration. Do not use seed after its date of expiration. Each variety of seed shall have a purity of not less than 90 percent by weight, a percentage of germination not less than 80 percent by weight, and a weed to seed content of not more than 0.75 percent by weight and contain no noxious weeds. Furnish seed mixtures having seed proportioned by weight in accordance with Tables 02930-1A, 02930-1B, 02930-1C, 02930-1D, and 02930-2. Any stabilization using crusting agent shall be followed by fall application of the appropriate permanent seed mix.
- B. Permanent seed mixes or areas to be seeded shall be treated with fungal (Mycorrhizae) inoculant and bacterial (Rhizobium) inoculants. The specified legumes must be inoculated with the appropriate Rhizobial strains.
- C. Furnish mulch meeting the following requirements:
1. Mulch shall be straw or wood cellulose fiber, free of clay, stone, foreign substances, and free of weeds.
  2. Straw should not contain sticks larger than 1/4-inch diameter or other materials that may prevent matting down during application. Use straw that is free from mold and other objectionable material for placing with mulch blower equipment or other equipment as approved by the Construction Manager. Straw shall be generally 6 inches or more in length.
  3. Straw shall be:
    - a. weed free straw from the Minnesota Crop Improvement Association or other certified weed free straw vendors;
    - b. straw that has been inspected and determined to be weed free by Central Ohio Seed Testing;
    - c. native prairie grass mulch; or
    - d. equivalent substitute as approved by the Construction Manager.
  4. Mulch applied by hydrospraying shall be a bonded fiber matrix containing wood fibers held together with a hydrocolloid-based binder, which upon drying becomes

insoluble and non-dispersible. The fibers shall be composed of 100 percent wood or wood by-products and shall be 100 percent biodegradable. Use a bonded fiber matrix containing a green dye that will provide for easy visual inspection for uniformity of slurry spread. The bonded fiber matrix, including dye, shall contain no growth or germination inhibiting properties. The wood cellulose fiber shall be manufactured in such a manner that, after addition and agitation in slurry tanks with water, the fibers in the material become uniformly suspended to form a homogeneous material. When sprayed on the ground, the material shall allow absorption and percolation of moisture. The wood cellulose fiber shall meet the following requirements:

<u>Item</u>	<u>Specification Limit</u>
Particle Length	0.4 inch (maximum)
Particle Thickness	0.047 inch (maximum)
PH	4.0 to 8.5
Ash Content	1.6 % (maximum)
Water Holding Capacity (based on fiber dry weight)	500 % (minimum)
Moisture Content	12 % $\pm$ 3 % (by weight)

- D. Mulch binder agent shall be as approved by the Construction Manager and shall meet the following requirements:
1. The mulch binder shall be hydrocolloid base (guar gum) and shall not dissolve or disperse upon rewetting.
  2. The mulch binder shall not have hazardous characteristics of ignitability, corrosivity, reactivity, or toxicity as defined in 40 CFR Part 261, Subpart C, for a hazardous waste in either its pre-applied or cured states.
  3. The mulch binder shall have a flash point greater than 200°F. The mulch binder shall be neither a flammable nor combustible liquid per United States (US) Department of Transportation definition [U. S. DOT, 1994]. The mulch binder must not be susceptible to significant deterioration from exposure to the elements, including sunlight.
  4. The mulch binder shall be provided in concentrated solution and prepared so that it will not change in transportation or storage.
- E. The crusting agent shall be as approved by the Construction Manager and shall meet the following criteria:
1. Pine sap emulsion comprised of a 100 percent organic emulsion produced from naturally occurring resins (pine sap); or a mixture of Conwed Fiber's Enviroblend hydraulic mulch and Finn Corporation's A-500 Hydro-Stik tacking agent (mulch binder); or an approved equal;

2. Not comprised of chloride, lignosulfonate, petroleum, or asphaltic-type emulsions;
  3. Provide dust suppression and surface stability for exposed soils, both disturbed and undisturbed soils, and exposed coal fired ash (fly ash);
  4. Compatible with application via a hydro seeder, and must not require intense cleaning of equipment after application;
  5. Non-tracking (i.e., will not stick to boots or tires) once cured;
  6. Not have hazardous characteristics of ignitability, corrosivity, reactivity, or toxicity as defined in 40 CFR Part 261, Subpart C, for a hazardous waste in either its pre-applied or cured states;
  7. Have a flash point greater than 200 °F;
  8. Be neither a flammable nor combustible liquid per DOT definition; and
  9. Not be susceptible to significant deterioration from exposure to the elements, including sunlight.
- F. Erosion mat shall be in accordance with Section 02270.
- G. Fertilizer:
1. Furnish commercial grade fertilizer, uniform in composition that meets the requirements of all State and Federal regulations and standards of the Association of Agricultural Chemists.
  2. Fertilizer shall be slow release complete fertilizer.
  3. Two types of fertilizer mixes shall be used. Fertilizer for application within the Southern Waste Units and the Former Production Area shall be 34-0-10; other fertilizers may be approved by the Construction Manager for the former production area, but they must not contain phosphorous. Fertilizer for other areas shall be 22-5-10. Fertilizers shall contain not less than 1 percent added sulfur and not more than 8 percent added iron, or an approved equal.
  4. Fertilizer must have MSDS submitted in accordance with this Section.
  5. Fertilizer shall be used for interim seeding only, unless otherwise approved by the Construction Manager.
- H. Construction water shall be obtained from the on-site water source shown on the Construction Drawings.

## 2.02 EQUIPMENT

- A. Provide equipment of size and type to perform work specified in this Section.

**PART 3 EXECUTION****3.01 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver containerized materials in uniform packages bearing the name of the manufacturer, the net weight and a statement of content. Deliver containerized materials to the site in original, properly labeled, unopened, clean containers each showing the manufacturer's guaranteed analysis conforming to applicable regulations and standards.
- B. Store materials in a dry area in a manner to prevent physical damage.

**3.02 GENERAL**

- A. Stabilization of disturbed areas by vegetation or by use of a crusting agent shall be performed at completion of excavation and stockpiles or within 7 calendar days of knowing a disturbed area will be idle for more than 45 calendar days, whichever is sooner.
- B. Crusting agents may be used as temporary measures prior to placement of interim vegetation after approval for the area by the Construction Manager.
- C. Interim vegetation, as specified in this Section, is required for all areas except OSDF final cover system and soil stockpiles, which are scheduled to be disturbed in future. Interim vegetation shall also be used to establish cover within forest patches planted in Site Restoration Projects. Fertilizer shall be used for interim vegetation as specified in this Section.
- D. Permanent vegetation is required as specified. Fertilizer generally shall not be used with permanent vegetation as specified in this Section. Fertilizer use may be determined appropriate by the Restoration Ecologist depending on specific field conditions.
- E. Disturbed areas which are scheduled to be disturbed after initial stabilization and/or need effective erosion control immediately, are to be stabilized with the interim seed mix rate specified in this Section. Disturbed areas which are not scheduled to be disturbed again are to be stabilized with the permanent seed mix rate specified in this Section. Soil piles, which require effective erosion control immediately, are to be stabilized with the interim seed mix rate or a crusting agent as specified in this Section.
- F. Stabilization of permanent slopes between 2H:1V and 3H:1V (horizontal to vertical) shall utilize an erosion mat as specified in Section 02270 after application of seed mixture. Erosion mat (i.e., Jute or approved equivalent) shall also be used on each OSDF Cap after seeding has occurred.

- G. Area(s) to be seeded shall be generally free of debris, rock, root material, and other objects that may impede soil preparation and seeding activities. Perform soil preparation by tilling/cultivating, to a depth of approximately 2 inches, to eliminate uneven areas and low spots. Maintain lines, levels and contours.
- H. Repeat cultivation in areas where equipment used for hauling and spreading has compacted the area(s) to be seeded.

### 3.03 APPLICATION

- A. The seeding season, for interim vegetation specified in this Section, is year round. However, if seeding is contemplated during the winter months of December through March, then field conditions should be assessed for ability to provide soil to seed contact. If field conditions do not support the ability to provide soil to seed contact then the area can be stabilized with a crusting agent followed by seeding during conditions conducive to adequate soil to seed contact.
- B. The seeding seasons for permanent seeding in wet and dry areas are Spring Season between April 1 and June 30 and Fall Season between September 15 and December 31. Seeding during the winter months is also acceptable if weather and field conditions are determined appropriate by the Restoration Ecologist and Construction Manager.
- C. Apply fertilizer, seed, and mulch to disturbed areas and areas excavated and graded under this Contract requiring seeding unless otherwise directed by the Construction Manager. Apply mulch within 24 hours of seeding; do not seed areas in excess of that which can be mulched within 24 hours. Winter application of seed and related materials are subject to adjustment as directed by the Construction Manager.
- D. Apply seed using either the drilling, broadcasting, or hydroseeding method, as described below:
1. Seed drilling method:
    - a. This method shall be used for applying the permanent seed mix in accessible areas unless otherwise approved by the Construction Manager. The method may also be used for interim vegetation.
    - b. Prepare area to be seeded by loosening the soil to a minimum depth of 3 inches.
    - c. Apply commercial grade, slow release complete fertilizer, for all interim vegetation and permanent vegetation as determined appropriate, at a rate of 150 lbs/acre at the time of preparing the seedbed for seeding.
    - d. Install seed with a seed drill to obtain a final planting depth of  $\frac{1}{4}$  to  $\frac{1}{2}$  inch using the seed rates indicated in Tables 02930-1A, 02930-1B, 02930-1C, 02930-1D,

and 02930-2. All seed drilling should be done perpendicular to the direction of surface-water flow to the degree possible.

2. Broadcast Seeding Method:

- a. This method may be used for interim vegetation, and can be performed with the use of mechanical "cyclone" seeders, by hand seeding or by any other method which scatters seed over the soil surface.
- b. This method may also be used for permanent seeding in areas that are not accessible with the seed drill (i.e., sloped areas) as approved by the Construction Manager and the Restoration Ecologist.
- c. If Broadcast Method is used to apply permanent seed mix in sloped areas (3H:1V slope or steeper), seeding application rates in Tables 02930-1A and 02930-1B, 02930-1C, 02930-1D should be doubled.
- d. Prepare the area to be seeded by loosening the soil to a minimum depth of 3 inches. This is critical to allow seeds to filter into the soil to avoid washout from runoff.
- e. Apply commercial grade, slow release complete fertilizer as needed at a rate of 150 lbs/acre at the time of preparing the seedbed for seeding.
- f. Install seed by broadcasting evenly over the entire site using the seed rates indicated in Table 02930-2.
- g. Rake the area after seeding.
- h. Lightly compact the seeded area with a roller or equivalent to ensure proper soil to seed contact.
- i. Mulch and disc-anchor using weed free mulch at a rate of 2.0 tons per acre. Spread straw mulch, either by hand or by blowing method, at the rate of 2 air-dried tons per acre. During June through September, increase straw mulch application rate to 3 air-dried tons per acre. Application of straw mulch by the blowing method is exempt from the dust control requirements specified in Part 6 of the Contract Documents.

3. Hydroseeding Method:

- a. This method may be used for interim vegetation only. Hydroseeding shall be a two-step process. The seed shall be applied first, followed by a separate application of the mulch. This is to ensure soil to seed contact.
- b. The mixture tank shall be cleaned prior to use to ensure remnant seed is not introduced to the proposed seed mixture.
- c. Prepare area to be seeded by loosening the soil to a minimum depth of 3 inches. This is critical to allow seeds to filter into the soil to avoid washout from runoff.

- d. Apply commercial grade, slow release complete fertilizer, for interim vegetation only, at a rate of 150 lbs/acre. The fertilizer is to be mixed and applied with the mulch.
- e. Install seed by hydroseeding evenly over the entire area using the seed rates indicated in Table 02930-2. Use a fan-type nozzle with approximately 500 gallons of water per acre to ensure even distribution.
- f. Rake the area where accessible following seeding.
- g. Apply sprayed mulch at a net dry weight of 2,000 pounds per acre minimum and 100 percent continuous coverage. Mix the mulch with water at a ratio of 50 pounds of mulch per 100 gallons of water.

E. Application of Crusting Agent:

1. Apply crusting agent in accordance with manufacturer's directions.
2. Unless otherwise specified by the manufacturer, dilute concentrated pine sap emulsion to ratio of 4 parts water to 1 part concentrate. Apply diluted pine sap emulsion at a rate of 2,500 gallons per acre.
3. Apply a mixture of Conwed Fiber's Enviroblend hydraulic mulch and Finn Corporation's A-500 Hydro-Stik mulch binder, using the hydroseeder, at the rate of 1,000 lbs/acre on flat surfaces; and 1,125 lbs/acre on slopes greater than 3H:1V. The mixture rate for each product shall be 20 lbs/acre on flat surfaces and 30 lbs/acre on greater than 3H:1V slopes for the hydraulic mulch; and 20 lbs/acre on flat surfaces and 30 lbs/acre on slopes greater than 3H:1V for the Hydro-Stik mulch binder.

### 3.05 MAINTENANCE

- A. Maintain the vegetated areas in satisfactory condition until acceptance of the vegetation by the Construction Manager. Maintenance of the vegetated areas includes repairing eroded areas, revegetating when necessary, watering, and mowing (if applicable). A satisfactory condition of vegetated area is defined as follows:
  1. An area shall have a predominant stand of the seeded vegetation;
  2. Within 3 weeks, germination must occur over 90 percent of the area with no single bare area greater than 3 square feet; and
  3. Within 3 months, 90 percent of the area must be covered with mature vegetation.
- B. The above timeframes for germination and coverage requirements are to be delayed during the dormant season between November 1 and March 15 application of the seed. The performance criteria shall be measured at the beginning of the growing season (April 1) for seed applied during the previous dormant season.

- C. Areas that fail to meet these requirements shall be repaired or reseeded as necessary to produce an acceptable stand of vegetation, as specified in this Section.
- D. The acceptance inspection will be performed by the Construction Manager who will determine whether repair of vegetated areas or revegetation is required.
- E. Maintain areas with a crusting agent to ensure proper erosion control. The crusting agent shall be reapplied to eroded and bare areas as necessary.

### **3.06 WARRANTY**

- A. Vegetated areas shall be subject to a warranty period of not less than 12 months from initial establishment of vegetation over 100 percent of the areas seeded.
- B. At the end of the warranty period, the Construction Manager and Restoration Ecologist will perform an inspection of the area. Seeded areas not demonstrating satisfactory condition of vegetation as specified in this Section, shall be repaired, reseeded, and maintained to meet requirements as specified in this Section at the Contractor's expense.

### **3.07 ACCEPTANCE**

- A. The vegetated areas shall be accepted at the end of the warranty period if a satisfactory condition exists as defined in this Section.
- B. After disturbed areas are stabilized and all necessary corrective work has been completed, the Construction Manager will certify in writing the final acceptance of the vegetated areas.

### **3.08 CONSTRUCTION QUALITY REQUIREMENTS**

- A. CQC Consultant will monitor vegetation and crusting agent application in accordance with this Section and Construction Quality Assurance (CQA) Plan.



TABLE 02930-1A

## SEED MIX IN UPLAND AREAS FOR PERMANENT VEGETATION

Species	Pounds Per Acre (lb/ac)
Big Bluestem ( <i>Andropogon gerardi</i> )	3
Little Bluestem ( <i>Andropogon scopariu</i> )	2
Side-Oats Grama ( <i>Bouteloua curtipendula</i> )	0.5
Indian Grass ( <i>Sorghastrum nutans</i> )	2
Canada Wild-Rye ( <i>Elymus canadensis</i> )	25
Switch grass ( <i>Panicum virgatum</i> )	0.5
ReGreen (n/a)	5
Wildflowers, uniform mix of the following:	1.5
Butterflyweed ( <i>Asclepias tuberosa</i> )	
Smooth Aster ( <i>Aster laevis</i> )	
Ox-eye Sunflower ( <i>Heliopsis helianthoides</i> )	
Bergamot ( <i>Monarda fistulosa</i> )	
Purple Coneflower ( <i>Echinacea purpurea</i> )	
Yellow Coneflower ( <i>Ratibida pinnata</i> )	
Black-Eyed Susan ( <i>Rudbeckia hirta</i> )	
Spiderwort ( <i>Tradescantia ohioensis</i> )	
Hoary Vervain ( <i>Verbena stricta</i> )	
Beardtongue ( <i>Penstemon grandiflorus</i> )	
Sweet Joe Pye-Weed ( <i>Eupatorium purpureum</i> )	
Blue False Indigo ( <i>Baptisia australis</i> )	
Partridge Pea ( <i>Cassia fasciculata</i> )	
Round-headed Bush Clover ( <i>Lespedeza Capitata</i> )	
Rattlesnake Master ( <i>Eryngium yuccifolium</i> )	
Stiff Goldenrod ( <i>Solidago risida</i> )	

TABLE 02930-1B

## SEED MIX IN WET AREAS FOR PERMANENT VEGETATION

Species	Pounds Per Acre (lb/ac)
Big Bluestem ( <i>Andropogon gerardi</i> )	3.0
Canada Wild-Rye ( <i>Elymus canadensis</i> )	25
Virginia Wild-Rye ( <i>Elymus virginicus</i> )	5.0
Switch Grass ( <i>Panicum virgatum</i> )	0.5
Blue Joint Grass ( <i>Calamagrostis canadensis</i> )	0.5
Porcupine Sedge ( <i>Carex hystericina</i> )	1 ounce per acre (oz/ac)
Fox Sedge ( <i>Carex vulpinoidea</i> )	1 ounce per acre (oz/ac)
Dark Green Bulrush ( <i>Scirpus atrovirens</i> )	1 ounce per acre (oz/ac)
ReGreen (n/a)	5.0
Prairie Cordgrass ( <i>Spartina pectinata</i> )	1.0
Wildflowers, uniform mix of the following:	1.5
Red Milkweed ( <i>Asclepias incarnata</i> )	
New England Aster ( <i>Aster novae-angliae</i> )	
Wild Senna ( <i>Cassia hebecarpa</i> )	
Great Blue Lobelia ( <i>Lobelia siphilitica</i> )	
Boneset ( <i>Eupatorium perfoliatum</i> )	
Blue Vervain ( <i>Verbena hastata</i> )	
Spotted Joe-Rye Weed ( <i>Eupatorium maculatum</i> )	
Cardinal Flower ( <i>Lobelia cardinalis</i> )	
Sawtooth sunflower ( <i>Helianthus grosseserratus</i> )	

TABLE 02930-1C

## SEED MIX IN SANDY DRY AREAS FOR PERMANENT VEGETATION

Species	Pounds Per Acre (lb/ac)
Big Bluestem ( <i>Andropogon gerardi</i> )	0.5
Little Bluestem ( <i>Andropogon scopariu</i> )	3.0
Side-Oats Grama ( <i>Panicum virgatum</i> )	5.0
Canada Wild-Rye ( <i>Elymus canadensis</i> )	25
Annual Rye ( <i>Lolium multiflorum</i> )	5.0
Indian Grass ( <i>Sorghastrum nutans</i> )	0.5
Prairie Dropseed ( <i>Sporobulus heterolepis</i> )	1.5
Wildflowers, uniform mix of the following:	(ounces per acre)
Butterflyweed ( <i>Asclepias tuberosa</i> )	5.0
Smooth Aster ( <i>Aster laevis</i> )	0.25
Blue False Indigo ( <i>Baptisia australis</i> )	4.0
White False Indigo ( <i>Baptisia leucantha</i> )	4.0
Partridge Pea ( <i>Cassia fasciculata</i> )	3.0
Purple Coneflower ( <i>Echinacea purpurea</i> )	3.0
Ox-eye Sunflower ( <i>Heliopsis helianthoides</i> )	1.75
Lupine ( <i>Lupinus perennis</i> )	7.0
Bergamot ( <i>Monarda fistulosa</i> )	0.25
Beardtongue ( <i>Penstemon grandiflorus</i> )	1.0
Yellow Coneflower ( <i>Ratibida pinnata</i> )	0.25
Black-Eyed Susan ( <i>Rudbeckia hirta</i> )	0.25
Stiff Goldenrod ( <i>Solidago rigida</i> )	0.25
Hoary Vervain ( <i>Verbena stricta</i> )	0.5

TABLE 02930-1D

## SEED MIX FOR PERMANENT VEGETATION ON OSDF CAP

Species	Pounds Per Acre (lb/ac)
Little Bluestem ( <i>Andropogon scoparius</i> )	3.0
Side-Oats Grama ( <i>Bouteloua curtipendula</i> )	5.0
Canada Wild-Rye ( <i>Elymus canadensis</i> )	25
Switch grass ( <i>Panicum virgatum</i> )	1.0
Prairie Dropseed ( <i>Sporobolus heterolepis</i> )	1.5
Buffalo Grass ( <i>Buchloe dactyloides</i> )	1.0
Annual Rye ( <i>Lolium multiflorum</i> )	10
Wildflowers, uniform mix of the following:	(ounces per acre)
Butterflyweed ( <i>Asclepias tuberosa</i> )	3.0
Smooth Aster ( <i>Aster laevis</i> )	0.25
Blue False Indigo ( <i>Baptisia australis</i> )	3.5
Partridge Pea ( <i>Cassia fasciculata</i> )	2.0
Purple Coneflower ( <i>Echinacea purpurea</i> )	2.0
Ox-eye Sunflower ( <i>Heliopsis helianthoides</i> )	1.75
Bergamot ( <i>Monarda fistulosa</i> )	0.25
Beardtongue ( <i>Penstemon grandiflorus</i> )	1.00
Yellow Coneflower ( <i>Ratibida pinnata</i> )	0.375
Black-Eyed Susan ( <i>Rudbeckia hirta</i> )	0.125
Stiff Goldenrod ( <i>Solidago rigida</i> )	0.750
Spiderwort ( <i>Tradescantia ohioensis</i> )	1.0
Hoary Vervain ( <i>Verbena stricta</i> )	0.50

TABLE 02930-2

## SEED MIX FOR INTERIM VEGETATION

Species	Pounds Per Acre (lb/ac)
ReGreen (n/a)	40
Annual Rye Grass ( <i>Lolium multiflorum</i> )	20
Canada Wild Rye ( <i>Elymus canadensis</i> )	20
Partridge Pea ( <i>Cassia fasciculata</i> )	2 oz./Acre
Black-Eyed Susan ( <i>Rudbeckia hirta</i> )	2 oz./Acre

[END OF SECTION]

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